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ARTICLE No. 1.

Tibetan and Bhotia Blood Group Distributions.

By EILEEN W. E. MACFARLANE.[1]

In 1937 a small sample (56) of Tibetan bloods was grouped at Kalimpong on the southern end of the Tibetan trade route in North Bengal (Macfarlane, 1937). In November 1941 a visit was made to Darjeeling in the foot-hills of the Himalaya Mountains a few miles west of Kalimpong and over a hundred more of these people from various parts were grouped. Bloods from sixty-five were also typed for M and N. They are generally very independent and superstitious and it is difficult to persuade them to give a little blood. Thanks to the co-operation of some local school authorities and missionaries, I was able to get both children and adults. It was not without a struggle that 117 blood samples were obtained. From these five sibs must be subtracted leaving 112 only.

The term Bhotia (or Bhutia) is a general one for Tibetans and certain hill people of Bhutan, Nepal and Sikkim States who possess some Tibetan intermixture. In the 1931 Census (Porter, 1933) 29,404 Bhotias were recorded from the Darjeeling District of Bengal. They were separated into the following four divisions: (*a*) *Bhotia of Bhutan* (Drukpa, Dukpa), (*b*) *Bhotia of Nepal* (Sharpa, Kahm, Nag Chhong, Salakha, Shakzang), (*c*) *Bhotia of Sikkim* (Dejong-Lhari, Dengongpa, Lhopa Bhotia), (*d*) *Bhotia of Tibet.* They are of course Mongoloids and the strain has been characterized by Guha (1937) as follows: 'medium to tall stature, round broad head and face, with high cheek bones and long flat nose. There is very little hair on the face and body and the skin colour is light brown tinged with a reddish tint'.

In Darjeeling the Tibetans tested were mostly poor people—mule drivers, coolies and beggars. In Nepal, Bhutan and Sikkim the Bhotias are a mixture of Tibetan and aboriginal strains, such as the Lepchas. Neither sex has any scruples against racial admixture, therefore the data from the Bhotias born in Tibet have been separated from those born in Sikkim and the Darjeeling District. The Tibetans were chiefly from Central Tibet (Shigatse and Lhasa) or Eastern Tibet (Chumbi, Kham and Yatung). Some of them may be mixed with the Chinese (Macfarlane, 1937). Including the 1937 data (from which three sibs have been subtracted leaving 53) there are altogether 80 Tibetan Bhotias (41 tested in 1937) and 85 from Sikkim and Darjeeling District

[1] Collaborator in Asiatic Research at the University of Michigan, U.S.A.

(12 tested in 1937). These data are given in Table I together with the blood group distribution found among the 112 mixed Bhotias in 1940 and in a total of 165 mixed Bhotias made up of the latter plus the 53 grouped in 1937.

The Tibetan Bhotias show over 9% more of Group A than the mixed Bhotias and over 10% less of Group AB. Although the two samples are small these differences indicate that in the region of Sikkim the Tibetans, rich in agglutinogen A, are mixing with people who have more of Group B. I still have data from only 33 Lepchas (8 more than in 1937) and the numbers found within the different blood groups are: Grup O 10, Group A 12, Group B 9, Group AB 2. Only one sample of less than a hundred mixed Nepalis has been published (Macfarlane, 1937).

It has been pointed out by Boyd (1939) that according to Bernstein's theory of the inheritance of the blood groups, which is now thoroughly established, the sum of the frequencies of the three genes $(p+q+r)=1$, except for chance deviation; when the difference actually found (D) is divided by its standard deviation (σ) the result should not exceed 2, where the variations are due to chance. In this way Boyd has tested all available anthropological blood group data. When D/σ is more than 2 the data are 'unsatisfactory, due to inhomogeneity of the population, or errors in technic, or both'. (Boyd.)

The values of D/σ for the different samples in Table I are interesting. For Tibetan Bhotias, the value is only 0·5, while for the Bhotias born in Sikkim and Darjeeling it is 3·06. Errors in technique may be ruled out since the two sets of data were collected together and sorted out later. Therefore this high value for D/σ may be attributed to the recent racial interbreeding that is occurring among the Bhotias south of Tibet. If these two groups had not been examined separately no indication of the race mixture would have been gained from the mixed samples because the intermediate value of D/σ which is obtained is not larger than what might be due to chance.

In a sample of 187 Tibetan bloods grouped at Lhasa by Tennant and reported by Gates (1935) the extraordinarily high percentage of 24·1 of Group AB was found ($D/\sigma=4{\cdot}21$). In Boyd's list (1939) among 49 samples from all parts of the world showing over 15% Group AB 40 have a value for D/σ of over 2·0. In cases where the technique used can be relied upon percentages of Group AB of this order also seem to indicate a racially mixed sample or genetic inequilibrium in the population.

The Bhotias from Sikkim and Darjeeling grouped in 1940 were mostly boarders and day pupils in the local colleges and schools.

In Table II blood group distribution in all Bhotias tested is compared with that found in the Khasis at Cherrapunji, Assam, in 1939 (Macfarlane, 1941) and in Chinese in Hu-Nan, central China (Li-Chi-Pan, see Boyd).

The Khasis are a matriarchal tribe of mongoloid aborigines of the Khasi Hills, Assam, and are known to be somewhat mixed genetically. Their traditions say that they came from the north and their blood group distributions are of the same order as those among the Bhotias. The Lushai and Angami Naga of the mountains of east Assam also show high percentages of Groups O and A but less of Groups B and AB than the Khasis (Mitra).

Most of the blood group data from the Chinese populations (Boyd) are from eastern areas and show more of Group B than found in the Bhotias or Khasis, but in the large sample from Hu-Nan the distribution is of the same order. This indicates that the blood group distribution among mongoloid peoples in a large area from western China through Tibet to the Himalayan States and central Assam is much the same, although the final proportions may have been brought about by different racial ingredients.

Blood Types.—A limited amount of anti-M and anti-N fluids were available and 65 bloods from Bhutias born in Sikkim and Darjeeling District were typed (see Table III). Even though the sample is small the results resemble closely those of the distribution of blood types among a population of mixed Indians (mostly Bengalis) at Calcutta (Greval *et al.*) Type N seems to be scarce (under 10%) among the Bhotias as it is among the mongoloid American Indians. Chinese at Hong Kong were found to have 18·2% of Type N (Ride in Boyd). These and the Japanese have a blood type distribution resembling that found in western Europe.

Summary.—1. One hundred and twelve mixed Bhotias were grouped at Darjeeling, North Bengal. They showed less of Group B than of Group A and over 10% of Group AB.

2. When those born in Tibet were separated from those born in Sikkim or Bengal the former were found to be genetically in equilibrium serologically and the latter showed signs of racial mixture.

3. The Bhotias of Sikkim are known to have interbred with the Lepchas. They show three times as much of Group AB as the Tibetans, and this increase is at the expense of Group A.

4. The blood group distribution in mixed Bhotias is of the same order as that found in the Khasis of Assam.

5. A small sample of bloods was typed and indicates that Type N is scarce among the Bhotias and that the types are distributed as among the Bengalis.

Table I. The Distribution of the Blood Groups among Bhotias.

Description of Sample.	No.	Nos. and Percentages in Groups.				Frequencies.			
		O	A	B	AB	p	q	r	D/σ
Mixed Bhotias, 1940	112	38 *33·92*	36 *32·14*	25 *22·32*	13 *11·61*	·230	·168	·582	1·25
All Bhotias, 1937 & '40	165	61 *36·97*	53 *32·12*	34 *20·61*	17 *10·30*	·223	·151	·608	1·5
Born in Tibet	80	31 *38·75*	29 *36·25*	16 *20·0*	4 *5·0*	·243	·144	·622	0·5
Born in Sikkim and Darjeeling District	85	31 *36·47*	23 *27·07*	18 *21·17*	13 *15·29*	·193	·154	·604	3·06

Table II. Blood Groups in Bhotias, Khasis and inland Chinese.

People.	No.	Percentages in Groups.				Frequencies.			
		O	A	B	AB	p	q	r	D/σ
Bhotias (mixed)	165	36·976	32·121	20·606	10·303	·223	·151	·608	1·5
Khasis (Macfarlane)	200	33·0	35·0	18·5	13·5	·261	·168	·563	1·7
Chinese of Hu-Nan (Li-Chi-Pan)	1296	31·9	39·0	19·4	9·8	·277	·150	·565	1·4

Table III. Blood types M and N in Bhotias (mixed).

People.	No.	Nos. and Percentages in types.			Frequencies.		
		M	MN	N	m	n	D/σ
Mixed Bhotias ..	65	28 *43·1*	32 *49·2*	5 *7·7*	·667	·298	5·61

Acknowledgement.

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ARTICLE No. 2.

Observations on the method of Carp Culture in the so-called Salt Lakes near Calcutta, with a note on the Fish Fauna of the Lakes.

By PURNENDU SEN.

(*Communicated by Dr. S. L. Hora.*)

I. INTRODUCTION AND GENERAL CONSIDERATIONS.

The Salt Lakes to the east of Calcutta have long been known for the abundance of their fish fauna, which up to a few years ago consisted mainly of brackish water forms such as *Lates calcarifer* (Bloch) and *Mugil parsia* Ham. (Gupta, 1908). *Hilsa ilisa* (Ham.) was also not uncommon when the lakes were fed by water from the tidal river Bidyadhari which of late has silted up; there is at present no ingress of saline water into the Salt Lakes from this source. Sewell (1934) in studying the fauna of the Salt Lakes also remarked on the rapid deterioration of the river Bidyadhari owing to deposition of silt during the flood tides. The natural process of delta-formation and the consequent changes in the river system, as also engineering constructions, such as bridges and canals, have also been instrumental in bringing the present moribund condition of the river (Sewell, 1934).

As a result of this deterioration and through repeated dilutions with rain water during the last few years the chlorine content of the lakes has decreased considerably (Table I), as

TABLE I.

Salinity in the Salt Lakes.

Year.	Chlorine contents per 100,000 parts.
1928	1,499 [1]
1936	950
1939	640
1940	130

N.B.—Readings were taken during the dry seasons from a northern point in the Salt Lakes (North).

[1] This figure obtained by Dr. K. P. Biswas is quoted by Sewell (1934), p. 59 and Neogi, S. K. (1936), *Rec. Mal. Survey of India*, VI, p. 43.

already pointed out by Sewell (1934) who came to a definite conclusion that the water in the lakes was gradually becoming more and more fresh. The vast water area of the lakes is consequently more and more utilized for the culture of freshwater species especially the carps. Several fish culture ponds have been started in the villages bordering on the Salt Lakes, and the lakes themselves are being more and more bunded up into small reservoirs or 'bheris' as time passes (*vide* Gupta, 1908).

II. Fish fauna of the Salt Lakes.

In directing routine surveys of Anophelines in the area, I kept field notes of the fish which were found in the Salt Lakes and in the several fish culture ponds. The various species of fish and common crustacea found in the Salt Lakes during the years 1937 to 1940 are listed in Table II.

Table II.

List of fishes and crustacea available in the Salt Lakes.

Scientific Names.	Local Names.
Pisces	
Family Megalopidae	
1. *Megalops cyprinoides* (Broussonet).	Amlet.
Family Clupeidae	
2. *Engraulis telera* (Ham.).	Fesha—Phansa*.
Family Notopteridae	
3. *Notopterus notopterus* (Pallas).	Folui—(Phola)—Pholui*.
Family Cyprinidae	
Subfamily Abramidinae	
4. *Chela bacaila* Ham.	Chela—Chela*.
Subfamily Rasborinae	
5. *Esomus danricus* (Ham.).	Danrke—(Danrica)—Danrika*.
Subfamily Cyprininae	
6. *Amblypharyngodon mola* (Ham.).	Maurala—Mawrala*.
7. *Barbus* (*Puntius*) *sarana* (Ham.).	Swarna punti—(Sarana)—Sarana punti*.
8. *Barbus* (*Puntius*) *sophore* Ham.	Safari punti—Punti*.
9. *Barbus* (*Puntius*) *ticto* Ham.	Tit punti—Tita punti*.
10. *Catla catla* (Ham.).	Katla—(Catla)—Katla*.
11. *Cirrhina mrigala* (Ham.).	Mrigal—(Mrigala)—Mrigala*.
12. *Cirrhina reba* (Ham.).	Kharke bata—(Batta)—Kharke-batta*.
13. *Labeo bata* (Ham.).	Bata—(Dommarci batta)—Bhangna*.
14. *Labeo calbasu* (Ham.).	Kalbose—(Kalbasu)—Kalbasu*.
15. *Labeo gonius* (Ham.).	Kurchi bata—(Karchi)—Karchi*.

N.B.—The local names in brackets and those marked with asterisks are according to Day (1876–78) and Shaw and Shebbeare (1937) respectively.

TABLE II (*continued*).

Scientific Names.	Local Names.
16. *Labeo rohita* (Ham.).	Rui—(Ruee)—Rui*.
Family Clariidae	
17. *Clarias batrachus* (Linn.).	Magur—(Mahgur)—Magur*.
Family Heteropneustidae	
18. *Heteropneustes fossilis* (Bloch).	Singi—(Singee)—Singhi*.
Family Siluridae	
19. *Wallagonia attu* (Bloch).	Boal—(Boyari)—Boal*.
Family Bagridae	
20. *Mystus tengara* (Ham.).	Tangra.
Family Cyprinodontidae	
21. *Aplocheilus panchax* (Ham.).	Techoke—(Panchax).
22. *Oryzias melanostigma* (McClelland).	Chuno.
Family Hemirhamphidae	
23. *Hemirhamphus limbatus* C.V.	Bogu.
Family Ambassidae	
24. *Ambassis nama* (Ham.).	Katchanda—Nama chanda*.
25. *Ambassis ranga* (Ham.).	Ranga chanda—(Chandee)—Ranga chanda*.
Family Ophicephalidae	
26. *Ophicephalus gachua* Ham.	Chang—Cheng*.
27. *Ophicephalus punctatus* Bloch.	Lata—Taki*.
28. *Ophicephalus striatus* Bloch.	Sole—(Sol)—Shol*.
Family Osphronemidae	
29. *Colisa fasciata* (Bl. Schn.).	Khalisa—Khalisha*.
Family Anabantidae	
30. *Anabas testudineus* (Bloch).	Koi—(Coi)—Koi*.
Family Nandidae	
31. *Nandus nandus* (Ham.).	Nadas—(Latha)—Nandus*.
Family Gobiidae	
32. *Glossogobius giuris* (Ham.).	Bele—Beley*.
Family Mugilidae	
33. *Mugil corsula* Ham.	Khorsola—(Corsula).
34. *Mugil parsia* Ham.	Parse—(Tarui).
35. *Mugil tade* Forsk.	Bhangan (Bangon).
Family Scatophagidae	
36. *Scatophagus argus* (Bloch).	Pyra chanda.
Family Mastacembelidae	
37. *Mastacembelus pancalus* (Ham.).	Pankal—(Pangkal).
Crustacea	
Family Palaemonidae	
1. *Palaemon lamarrei* M.-Edw.	Kucho chingri.
2. *Palaemon carcinus* (Fabr.).	Mocha or Golda chingri.
Family Penaeidae	
3. *Penaeus carinatus* Dana.	Bagda chingri.
4. *Metapenaeus monoceros* (Fabr.).	Honye chingri.
Family Portunidae	
5. *Scylla serrata* (Forsk.).	Nona kankra.
Family Grapsidae	
6. *Varuna litterata* (Fabr.).	Chiti kankra.

N.B.—The local names in brackets and those marked with asterisks are according to Day (1876–78) and Shaw and Shebbeare (1937) respectively.

Lates calcarifer (Bloch) or the '*bhetki*' has become extremely rare in the area. It has been replaced by the carps; these do not breed in confined water but are introduced into the Salt Lakes area almost every year from distant nurseries. Fish like *Mystus tengara* and the mugils are also introduced in the shallow fish ponds of the area at fry or young stages from the navigation canals (Pl. 1, Fig. 1) bordering on the Salt Lakes and the '*bheris*'.

The Culture of Carps in the Salt Lakes area.

Usually towards the end of March, the ponds designed for carp culture are completely dried by draining the water into the adjacent lakes (Pl. 1, Fig. 2), while several of the shallow ponds dry up naturally during March. The ponds are then cleaned of debris and vegetation and the edges are trimmed. The mud exposed to the sun soon gets completely dried and is then broken up into dust. After these preliminary measures the ponds are filled up with water from the adjoining '*bheris*' towards the end of May or in June through small cuts, sometimes water is also introduced either with the help of a '*donga*' (Pl. 1, Figs. 3 and 4) which is a dug-out trunk of a palm tree or with a '*seoni*' (Pl. 1, Fig. 5), an improvized basket made of palmyra leaves or of tin sheets. The rains also start at this time. The tiny fry of carps are then introduced into these ponds, the number introduced depending on the size of the pond.

The introduction of fry in the Salt Lakes area (Pl. 1, Fig. 6) begins towards the end of May or in June and continues uptil July, while fingerlings are introduced during September and even in October. Heavy showers of rain within two days of the introduction of the tiny fry in the ponds, are believed to be detrimental to the life of the fish.

The rate of growth of carps is not uniform in all ponds. The young of the larger forms such as *Labeo rohita*, *Cirrhina mrigala*, *Catla catla*, etc., normally grows to $\frac{1}{4}$ seer in one year although instances of carps growing to $\frac{3}{4}$ of a seer in one year are not rare. 'Bhetki' also, according to Gupta (1908), grow to $\frac{1}{4}$ seer in the Salt Lake '*bheris*' in course of a year, that is to say, in the second year of introduction. The latter author further mentions that in Bavaria, the carps can attain a weight of 1 to 2 lb. in the second year. Both in America and Europe, carps are nurtured under adequate supervision and feeding is done scientifically, as against the empirical methods followed in this country.

The carps when sufficiently grown are disturbed by beating the water with bamboo poles, etc., as movements of fish in the ponds resulting from this disturbance are believed to result in rapid increase in size; growth to a size one seer or more in the course of two years has been noted as a result of such

treatment. During February and March one often notices fish being thus agitated in the Salt Lakes.

Food supply.—Food in the form of rotten water hyacinth, sullage water and algae is supplied to the fry. The hyacinth is first allowed to rot and then introduced in the ponds. The dried mud from bed of sullage canals is also used as food of the fish fry, as also the algae and other micro-organisms growing around grasses on edges of ponds. Some people in the absence of sullage water prefer the introduction of *Lemna* which is eagerly eaten by the fry (*vide* Chatterji, 1934). The food of carps as already pointed out by Gupta (1908) constitutes mostly of vegetable matter while the animal food consumed is composed of insect larvae, small crustacea and mollusca and other similar organisms (Mookerjee, 1938). Given the suitable food the minute fry will grow to a size of one to three inches within three months of introduction. Gupta (1908) noted carps growing to 16 or 17 cm. in length in the first year.

Great discrimination has to be exercised in supplying the food matter to the growing fish and if the food is not of the proper type the fry die. The favourite food of the minute fry consists of micro-plankton, such as Infusoria (*Paramoecium*, according to Chatterji, 1934), diatoms and minute unicellular algae, for the bigger fry or the fingerlings, minute crustaceans such as *Daphnia* and *Cyclops* in addition to algae, and for the fairly adult stage, earthworms, chironomid larva and higher crustaceans such as shrimps, in addition to microscopic forms like *Daphnia*, *Cyclops* and algae (*vide* Innes, 1932).

Mortality among the fry and fingerlings may be very high owing to congestion and lack of proper food. The distribution of young stages of carps from a rearing pond where congestion is noticeable to several ponds is useful as it ensures a better development of the fry. Another good practice often noticed in the areas in which fish are cultured is frequent dragging by nets. This helps in the removal of the slimy matter often of algal origin, and external parasites from the body of the fish. De (1910) mentions the practice of planting bamboo sticks and posts in the middle of the tanks to enable fish to rub off their external parasites. The agitation set up in the water column by the dragging of nets also helps in the partial removal of the gaseous formations from the substratum of the ponds. The mortality of fish is very heavy in foul water which is not properly aerated and bears an excessive amount of carbonic acid gas, or when the temperature of the water is high (Gupta, 1908; Sewell, 1926; Pruthi, 1932; Sen, 1939). The dragging of nets further ensures brisk movement which is highly beneficial for the healthy growth of the fish.

Some people allow soap water in their ponds which are found unfavourable for the growth of fish probably to increase the alkalinity of the water; this especially in acidic waters is

reported to have yielded good results. A similar practice of soaking plantain fellings, rich in alkali, in waters fouled by the stifling of jute, is followed in parts of East Bengal (Gupta, 1908).

Natural enemies of the fry.—The so-called eggs which are nothing but the tiny fry of the carps are preyed upon by the frogs *Rana tigrina*. Fish of the genera *Barbus* and *Ambassis* are also harmful to the fry of the carps, the former feeds voraciously on the food matter available in the ponds, while the latter may inflict injury to the fry by their sharp spines. Sometimes fry of certain carnivorous fish like *Wallagonia* are accidentally introduced into the ponds along with the fry of carps. This should be guarded against, otherwise there will be a great fall in the yield of carps. Thick growths of *Hydrilla* and *Ceratophyllum* hamper the normal development of the fish fry. Very little of such aquatic vegetation should be permitted to grow in the ponds where carps are being reared, and predator fish like *Ophicephalus*, *Notopterus* and *Wallagonia* should be removed as soon as they are detected in the ponds in order that the commercial species of carps can thrive (Chatterji, 1934; Hora and Mukerji, 1938).

In conclusion, I am grateful to Mr. K. N. Das of the Zoological Survey of India for his assistance in the identification of the fish recorded in this paper and in various other ways. Further, I am greatly indebted to Drs. B. Prashad and S. L. Hora for the many valuable suggestions I have received from them.

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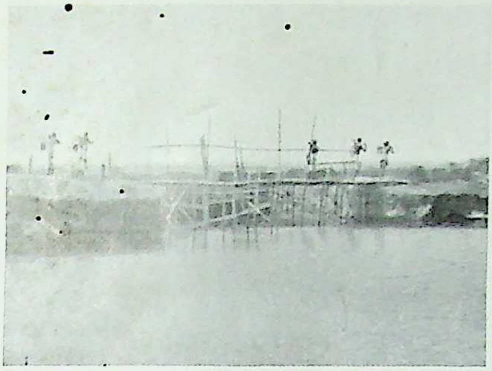

FIG. 1. Kristopur canal showing a cut to connect with the Salt Lake 'bheris'.

FIG. 2. A fish pond dried by drawing the water into the Salt Lakes.

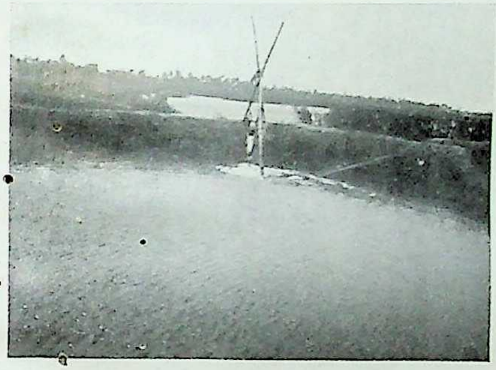

FIG. 3. 'Donga' utilized in introducing water into a pond for fishery.

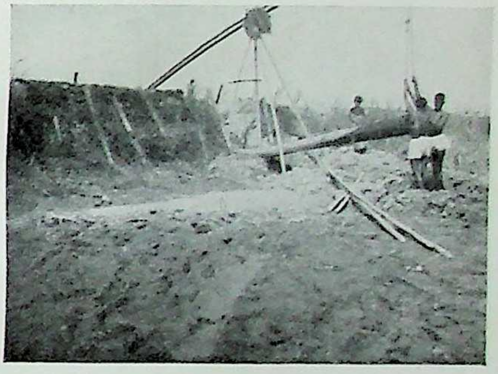

FIG. 4. A closer view of a 'donga'.

FIG. 5. 'Seoni' used in bailing out water.

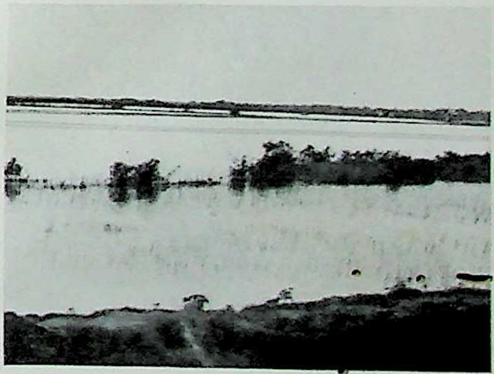

FIG. 6. A view of Salt Lake 'bheris'.

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ARTICLE No. 3.

Blood Groups among Balahis (weavers), Bhils, Korkus, and Mundas, with a note on Pardhis, and Aboriginal Blood Types.

By EILEEN W. E. MACFARLANE.[1]

A visit was made early in 1941 to the Nimar District in the Western Central Provinces, India, primarily to get more blood groups from the aboriginal Bhils. While biding my time to go to the Bhil villages, I was able to get a good sample of bloods from the Balahis at Khandwa and later some aboriginal Korkus and a few nomadic Pardhis were also grouped.

The methods used were the same as on previous trips and have been described (Macfarlane, 1940).

The *Balahis* are a lower caste of Hindu weavers, labourers, and servants of the Hoshangabad and Nimar Districts. The number of Balahis in the Central Provinces and Berar returned in the 1931 census was 56,782, and over half a million in India, chiefly in Rajputana and Central India. Although they are an 'impure' caste who cause pollution to caste Hindus, they rank above the lowest occupational castes of untouchables such as the Chamārs (leather workers) and Mehtars (scavengers) in the Hindu social scale.[2]

Their position is on a par with those of the large Mahār and Mang castes who are widespread in Western and Central India. According to their traditions they came to the Nimar from the north-east, and they are considered to be a branch of the Kori caste of weavers in the United Provinces (Russell). Russell (1916) mentions that in the Hoshangabad District they are known alternately as Mahārs and that the latter caste is also sometimes called Dher. In the Nimar the Balahis rank above Mahārs, and have no social dealings with them. Russell also records that some of the Balahi sub-castes and endogamous groups are called by the names of castes: Katia, Kori, Mahār, and Gannore, and that the latter is a Rajput clan of left-handed descent.

Physically the Balahis show a considerable amount of variation especially in colouration and nasal form. Their noses often have a convex bridge, as in Guha's Alpo-Dinaric type (Guha, 1937) and an occasional person with hazel or grey eyes

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[1] Collaborator in Asiatic Research, University of Michigan, U.S.A.

[2] Lower than Balahis:—Chamārs, Mehtars, Basors, Mangs, Dhobis, Fermals (Father S. Fuchs private communication, June 1941).

occurs (figures 1 and 2). They take people into their caste from higher castes, such as an occasional outcaste upon his request, and adopt women who elope with a Balahi. According to Russell (1916) they admit Korkus and Gonds and any but the very lowest Hindu occupational castes. Father Fuchs, who has lived amongst them for some years, told me that in recent years only infrequently is an occasional individual thus taken in, usually a man who has become friendly with the Balahis through living with them, and no group as such has been received. Their culture shows some relics of a pre-Hindu religion now overlaid by the degenerate form of Hinduism which they profess (Fuchs, 1940). The Balahi sub-castes of the Nimar eat the flesh of cattle that have died. They claim to be the oldest inhabitants of the District (Russell) and this is confirmed by higher caste Hindus who know by tradition that their forefathers bought their fields from Balahis (Father Fuchs private communication, 1941).

After subtracting data belonging to members of the same immediate family, the blood group distribution was obtained from two hundred Balahis as shown in Table I.

The Balahi data are unusual for India, where there is characteristically a preponderance of Group B over Group A, especially in the lower castes, except in the south-west (Macfarlane, 1938). In the Balahis there is an equal distribution of the three main blood groups, a condition that has hitherto been found in this country only among the Mundas, and the related Maria Gonds far to the East, in the Mahrattas, Rajputs, Jats, and Pathans.[1] Because Balahis do not resemble the Mundari-speaking tribes in general appearance and have not been linked with them by scholars, we may neglect the Mundas at present. Until more blood group data are available from Rajputana, the United Provinces and Bombay we cannot speculate on the resemblance in blood group distribution between the Balahis and the castes listed above from those regions. The Balahis have been in contact since the middle ages with the Rajputs who twice migrated over this part of India during the Moghul wars of the fourteenth century and earlier (Russell).

The contrast between their blood group distribution and that found in the Depressed Classes of the Deccan (Macfarlane, 1940) is surprising. In a small sample (75) of the latter people were found 18·7% Group A and 44% Group B and a similar condition exists among the lower castes of South Bengal (Macfarlane, 1938). Majumdar (1940) in 92 Chamars in the United Provinces found 13·3% Group A and 38·3% Group B. Some of the higher castes in the United Provinces also seem to have a marked preponderance of Group B over A (Majumdar). In

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[1] For comparison of all samples see Boyd's Tables (1939) for original references, see also Macfarlane (1938).

Table II certain Indian races and tribes are listed with relation to the serological value of (A-B). The Balahi data seem to indicate that the ancestors of this caste originated chiefly from the north-west of their present habitat, since Indian groups possessing frequencies for both the genes A and B lying between 0·210 and 0·259 are the Balahis, Jats, Mundas, Rajputs, and Pathans only. The value 1·2 for D/σ (Table I) is not high enough to suggest genetic instability (Boyd). It would appear that any accessions to the Balahi caste in the past few generations have been genetically negligible. Serologically they are distinct from the depressed Mahārs and Dhers.

The *Bhils* of the Nimar are cultivators and tenant farmers inhabiting small scattered villages among the fields. They are descended from a war-like tribe of aboriginal hunters of the Vindhya, Satpura, and Ajanta Hills who caused a lot of trouble as freebooters during and after Moghul times. In the 1931 census 363,124 Bhils were returned from Central India and 30,325 from the C.P. and Berar. Their original Bhili speech was classified by Grierson (1906) as a Mundari language, but they have now given up their own dialect for Hindi. Centuries ago when the Rajputs came into the Bhil country the two peoples were closely associated for some generations, the Rajputs sometimes taking Bhil women for mates. This led to Hinduization and the disintegration of the tribe into separate endogamous groups based on the presence or lack of Rajput ancestors (Venkatachar). The Bhilallas are also descended from offspring of Rajput men and Bhil women (Russell).

Hinduized Bhils admit outsiders into the tribe from any communities except those of lower castes than themselves among which are Balahis and Nahals. Bhils and Balahis inhabited separate sections of the villages visited near Khandwa. In the last census it was reported that the Bhils were 'a very mixed lot'; a condition that was also confirmed by Dr. Guha for the Bhils that he measured in the Vindhya Hills (Guha, 1935). A marked variety of physical types was seen among the Hinduized Bhils whom I visited, but the prognathous, thick-lipped, often weak-chinned, platyrhine aboriginal type with high cheek bones, pronounced supra-orbital ridges and depressed root of the nose was infrequent. This is the type which Guha (1935, 1939) designated as *Nishadic* or Proto-Australoid, and its various facial characteristics seem to segregate out in individuals (see figures 7 and 8). None was seen with light coloured eyes.

If, as their blood group distribution indicates, the Balahis are closer to the more highly cultured folk living to the north-west of them, we have here an interesting example of a race more primitive physically and culturally—the Aboriginal Bhils—ranking higher in the Hindu socio-ritualistic scale than a people who are by descent more specialized or advanced in these respects—the Balahis. The degraded position of the latter is

perhaps partly due to their feeding habits, to their occupation of weaving (Russell) and also to the fact that they are a mixed caste with accretions from outcastes (Fr. Fuchs private communication).

Last year a few Hindu and Muslim Bhils from the Ajanta Hills were grouped in Hyderabad (Macfarlane, 1940) and an exceptionally high number, even for India, were found to belong to Group B. Khandwa was chosen to get more data because it is not far, about a hundred miles, from the Ajanta Hills. In 1939 Dr. W. Koppers took measurements and grouped bloods of Bhils in Jhabna State to the north and Korkus in Berar, but his data are not yet available. Father S. Fuchs was Dr. Koppers' assistant and I was fortunate to have his help in the Nimar.

The Hindu Nimar Bhils are friendly with the Christian missionaries who introduced me to them in some villages fifteen to twenty miles south-west of Khandwa. At first I was well received, but later their suspicions were aroused by some wise-acres at the weekly market, and I was unable to get the two hundred bloods as desired. After subtracting some close relatives data from 140 were left.

These Bhils also show a very high percentage of Group B and an unusually large amount of Group AB (Table I). The latter is indicative of heterogeneity. If Group AB people are taken into consideration then 58·8% of these Bhils possess agglutinogen B and 40% possess A. The Bhils in Hyderabad had Group B 52·3%, Group AB 2·3%. In all blood group samples for India of over one hundred available so far, only these Bhils, the Nimar Korkus and the Paniyans of South Malabar show a frequency for Group O (r) of under 0·50. The Paniyans have very little B. The fact that Guha (1935) found a definite association in CRL between the Bhils and the Chenchus is interesting because it suggests their possible relationship with the southern tribes of aborigines. The Chenchus resemble the Paniyans, alone among Indian tribes, in having a preponderance of Group A over Group B. If the Bhils are found to have southern affinities, this will further support the observation that as the southern aboriginal tribes migrated northwards they seem to have accumulated more of Group B, e.g. the Mālés and Oraons of Bihar (Macfarlane and Sarkar), see Table III. Excluding the Paniyans and Oraons, each of whom stand distinct serologically, there is seen to be relatively little variation in p (Table III), only 8%, between the four widely separated tribes Chenchu, Mālé, Korku and Bhil; whereas q increases among them 21% from south to north and east. The Chenchus and Mālés are Dravidian speaking, while both the Korkus and Bhils are believed to come from Mundari-speaking ancestors. The percentages of Groups B and AB in the Korkus and Bhils show some similarity with those found in the Todas of the Nilgiri Hills, South India, but the

latter have a lower frequency for the gene B, $q = 0{\cdot}278$, as well as for gene A, $p = {\cdot}157$, frequencies which are more like those found in the Santals, the non-caste Hindus of Bengal and the Depressed Classes of the Deccan. The racial affinities of the Todas are no doubt very mixed. They may have migrated to their present location from north central India, but there is nothing in their blood group distribution to support a Proto-Nordic descent. Their serological resemblance to other tribes in India is probably more significant than their resemblance to the Ainu in blood group distribution. (See Boyd's Tables 1939.)

The value for D/σ for these Bhils does not indicate a genetic instability, therefore the various racial elements in their blood group distribution have reached equilibrium. The high percentage of Group AB shows heretozygosity.

The *Korkus* are at present the westernmost tribe of those who speak a Mundari dialect (Grierson). At the time of the 1931 census there were 176,616 of them in the Central Provinces and Berar; 52,172 were returned for the Nimar District. They are believed (Russell) to be racially akin to other tribes in the Mundari-speaking group such as Baigas, Kols, Korwas, and Nahals of the C.P.; Mundas and Santals of Bihar. Their sept names are the same as those of the Kols (Russell). They will not eat with Gonds, but Gonds, also Mangs and other lower castes, accept food from them. Physically many of them resemble Guha's Proto-Australoid type (figures 5 and 6).

Most Korkus are timid, suspicious of strangers and difficult to contact. I am indebted to another Christian missionary through whose good offices I received the co-operation of the village Patel at Kanapur (Thomog on old maps) who employs many Korkus from neighbouring villages as agricultural labourers. These villages are some fifteen miles east of Berhanpur near the Berar border. After subtracting some persons belonging to the same family 140 individual blood samples were left.

The Korku village is unlike anything I have yet seen in India. The low wattle and thatch huts are built in two continuous straight rows on either side of a very wide central street. There is a space between the walls of two houses, usually, only where a street crosses.

The Korku data show a close resemblance to those of the Bhils (Table I) with slightly more of A and less of B. The differences are not significant and the χ^2 test [1] for the two gives the values $\chi^2 = 1{\cdot}33$, $P = 0{\cdot}73$ (kindly calculated by Mr. S. S. Sarkar), which demonstrated that they are samples from a genetically undifferentiated population as far as blood groups are concerned.

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[1] By the χ^2 test Todas and Korkus are also undifferentiated ($\chi^2 = 5{\cdot}85$, $P = 0{\cdot}12$) while Bhils and Todas are significantly differentiated ($\chi^2 = 15{\cdot}14$, $P = {\cdot}0017$) according to Mr. Sarkar's calculations.

As in the Bhil data the relatively high percentage of Group AB in Korkus shows some heterozygosity but the low value for D/σ indicates genetic stability for the blood groups at present. There are no published data of physical measurements from the Korkus but Dr. Koppers took some in Berar. In Nimar the Korkus speak Hindi, and have the status of a backward tribe under the Government. In the Hindu social scale the hinduized Korkus are on an equal footing with the Bhils. At Kanapur and elsewhere the Nahals, who are also of aboriginal stock (also classified as a backward tribe officially), do the lowest menial work as serfs of the Korkus. They were hunters and herb gatherers who have been exploited by the agricultural Korkus and are on the road to becoming a depressed, 'impure' caste. Hinduized Nahals rank a little higher than Balahis (Father Fuchs private communication).

Munda Blood Groups.

In October 1940 I obtained blood group data from 120 Mundas workers in the ore mines of south-east Bihar. They were from the Singbhum District, Bihar, and from the neighbouring Orissa States of Keonjhar and Mayurbhanj. This sample is therefore free from familial strains. The three main blood groups were found to be about equally distributed in these Mundas (Table I). Sarkar (1941) by applying the χ^2 test has found that these Munda data and his Santal data from the Santal Pergannas, Bihar, are samples from an undifferentiated population serologically. Among the Mundas and Santals 37% and 31% possess agglutinogen A respectively and 36·7% and 46% respectively carry B. The Korkus like the Bhils have an unusually high concentration of both agglutinogens, 42% of them have A and 52% have B. Isolation combined with differential fertility might produce the Korku type of blood group distribution, with excess of Group B, from a Munda-Santal type with equal amounts of A and B. If these Mundari-speaking people are another racial stock which entered India later than the southern aborigines, they have accumulated more of B as they proceeded west just as the southern tribes have as they came north (Macfarlane and Sarkar). The source of all this B is debatable. Statisticians have found that mutation is an unlikely source (Boyd, 1940) because the blood groups have no selective value and no indication of a high mutation rate has yet been discovered in family studies.

So far the only communities found in India with values for q of 0·26 and over are the Bhils, Korkus, Chamārs, Deccan Depressed Classes and several lower castes in south Bengal (Macfarlane, 1938). There may have existed an ancient stock in north central India, rich in B like the Oraons and like them a branch of the southern aborigines (Macfarlane and Sarkar)

which has been submerged nationally; now, degraded and exploited among the depressed classes, the race shows its effect in this dominant gene which seeps into every stock that comes to the Ganges Basin and central India.

In this way the Korkus and Bhils could be a product of a southern stock assimilated by the invading Mundari-speaking tribes who were later submerged themselves, to a large extent, by the Aryan-speaking invaders. Blood group studies therefore may give evidence for the existence of an older human stratum than those already recognized in this part of India.

The *Pardhis* are an aboriginal, nomadic tribe of hunters of central India. A band of Pardhis was awaiting trial at the jail at Khandwa and the authorities kindly allowed me to visit them for blood samples. There were only nineteen including a father and son (both Group B), three brothers (all Group O) and two brothers (both Group B). If only one member of a family is included that leaves fifteen bloods which were distributed thus: Group O—6, Group A—4, Group B—4, Group AB—1. This indicates that the Pardhis are well supplied with both agglutinogens. All the men had dark brown eyes and very dark skins, but they showed considerable structural variation and included pronounced aboriginal types (figure 4) as well as some who resembled the type Guha (1937) designates as the Indus or Mediterranean type (figure 3). Similar variations in racial type were recorded in the Todas by Cipriani.

Blood Types in Mundas and Bhils.

Only a small quantity of anti-M and anti-N test fluids were available. Since there are no data for blood types among Indian aborigines 65 Mundas in the Singbhum District, Bihar, were tested with anti-N and 57 Bhils in the Nimar, C.P., were tested with anti-M. The values for the frequencies m and n of the two genes were calculated from the formulae $n = \sqrt{\mathrm{N}}$, $m = \sqrt{\mathrm{M}}$ (Boyd, 1939) and are given in Table IV together with the percentages of the three types. These inadequate data indicate that these tribes possess less of M and more of N than the general population of Bengal (Greval, Macfarlane, 1939). It is interesting that the Mundas, who physically show fewer signs of racial intermixture (Macfarlane and Sarkar), have more N than the Bhils. Values for n of over 0·50 are listed by Boyd (1939) in peoples to the east of India only for the Ainu, Indonesians, Javanese, Sudanese and Australians. Blood type N seems to predominate more in the primitive races and early inhabitants.

SUMMARY.

1. The Balahis, lower caste weavers of the Nimar District, C.P., show more relationship, serologically, with the Mahrattas,

Rajputs, Jats, and Pathans west and north of them than with the Depressed Classes. They have the three main blood groups in equal proportions with a little more of Group A than of Group B.

2. The Bhils have high percentages of groups B and AB and the highest frequency for gene B yet found in India. The Korkus and Bhils are very similar in blood group distribution and seem to belong to an undifferentiated population.

3. There is some resemblance between the Korku and the Toda blood group distributions. It is suggested that the Korkus and Bhils, even if descended from Mundari-speaking ancestry may also have ancient affinities with the southern aborigines (Chenchus and Paniyans) from whom they differ serologically chiefly in possessing more B.

4. The Mundas of the Singbhum District, Bihar, show the three main blood groups equally distributed, but they do not differ significantly serologically from the Santals who have more of B.

5. As the Mundari-speaking tribes migrated westward in India, they accumulated more of Group B, perhaps from an aboriginal people with southern affinities whose descendants now are represented in the Depressed Classes.

6. A few of the nomadic aboriginal Pardhis showed all three blood groups present and a marked variation in racial types.

7. Mundas and Bhils, in small samples, each show less of type M and more of type N than the general population of Bengal.

Acknowledgments.

These investigations were made possible through a grant-in-aid from the Royal Society, London. I am also indebted to the friends, missionaries, and local officials who gave valuable help, particularly to Father S. Fuchs, S.V.D., for help and criticism.

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TABLE I.

The distribution of blood groups in three Nimar castes and in Mundas of South Bihar.

People.	No.	Nos. and Percentages in Groups.				Frequencies.			D/σ
		O	A	B	AB	p	q	r	
Balahis	200	61 *30·5*	64 *32·0*	60 *30·0*	15 *7·50*	·222	·209	·552	**1·2**
Bhils ..	140	26 *18·57*	33 *23·57*	58 *41·43*	23 *16·43*	·218	·344	·431	**0·3**
Korkus	140	28 *20·0*	40 *28·57*	53 *37·86*	19 *13·57*	·250	·313	·447	**0·4**
Mundas	120	40 *33·33*	36 *30·0*	45 *29·17*	9 *7·50*	·219	·214	·577	**0·6**

TABLE II.

Serological value A–B of Mundas, Nimar castes and related peoples, in ascending order.

Race or Caste.	(A–B)	Race or Caste.	(A–B)
*Todas ..	− 18·5	Mahrattas ..	− 7·2
*Bhils	− 17·8	Rajputs ..	− 5·0
*Santals ..	− 13·9	Pathans ..	− 2·0
Jats	− 11·0	*Mundas ..	− 0·8
*Korkus ..	− 9·3	Baluchs ..	0·0
*Maria Gonds ..	− 8·1	Balahis ..	+2·0

* Aboriginal Tribes.

TABLE III.

Blood Group gene frequencies in some southern and Nimar aborigines compared, in ascending order of q.

Tribe.	p	q	r
Paniyan ..	·461	·078	·447
Chenchu ..	·252	·133	·608
Mālé ..	·167	·181	·649
Oraon ..	·088	·219	·686
Toda ..	·157	·278	·545
Korku ..	·250	·313	·447
Bhil ..	·218	·344	·431

TABLE IV.

Blood Types and their frequencies in Mundas and Bhils.

Tribe.	No.	Percentage in Types.			Frequencies.	
		M	MN	N	m	n
Munda ..	73	23·29	49·99	26·73	48·3	51·7
Bhil ..	57	31·4	49·23	19·30	56·1	43·9

FIG. 1. Balahi girl.

FIG. 2. Profile of 1.

FIG. 3. Pardhi man.

FIG. 4. Pardhi boy.

FIG. 5. Korku man.

FIG. 6. Profile of 5.

FIG. 7. Bhil man.

FIG. 8. Profile of 7.

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ARTICLE NO. 4.

Observations on an intestinal flagellate, *Tetratrichomastix hegneri*, sp. nov., from the 'skipping frog' *Rana limnocharis* Meig.

By P. L. MISRA.

(*Communicated by Dr. K. N. Bahl.*)

CONTENTS.

INTRODUCTION.

During my short stay at the Protozoological section of the Imperial Veterinary Research Institute, Mukteswar-Kumaun in March 1940, I examined half a dozen specimens of the 'skipping frog' *Rana limnocharis* Meig.[1] for protozoan parasites in their guts. Besides Coccidia, *Entamoeba*, trichomonad flagellates and ciliates, I found a flagellate, which showed the characters of the genus *Tetratrichomastix* Young, 1935, in the posterior part of the intestine and rectum in two out of six specimens. This flagellate is the first of its kind to be recorded from India and second of its type to be described from a vertebrate host. I give below a morphological account of this organism which I have named *Tetratrichomastix hegneri*, sp. nov., after Prof. R. Hegner of John Hopkins University, who has made valuable contributions to our knowledge of the trichomonad flagellates.

MATERIAL AND METHODS.

The frogs were collected from a small pond at a height of about 6,000 ft. in the lower Himalayan range, about 4 miles away from the Mukteswar Institute. Fresh cover-glass preparations of the gut-contents, either as such or diluted with a little normal saline, were made and these flagellates along with

[1] The frogs were identified at the Indian Museum through the kind courtsey of Dr. S. L. Hora.

other protozoa occurring in association were examined in the living condition. Intra-vitam staining with neutral red was also employed to study the movement of the organisms in the living condition. Air-dried films of the gut-contents were fixed in acetone-free methyl alcohol and stained with dilute Giemsa to ascertain the number of flagella. For other structures, wet smears were fixed in hot sublimate-alcohol or Bouin's fluid and stained with iron-alum haematoxylin after the method of Heidenhain.

Observations on *Tetratrichomastix hegneri*, sp. nov.

The flagellates show characteristic jerky movements when examined in fresh condition. This type of movement at once reminds that of *Monocercomonas bufonis* Dobell (1908, 1909), or *Eutrichomastix* (*Trichomastix*) [1] *batrachorum* Dobell (1909), and, is perhaps due to the fact that the anterior flagella beat backwards in unison. The posteriorly directed flagellum also vibrates rapidly but it does not extend forwards up to more than three-fourths of the body from the posterior end during its lashing movements. It was impossible to count the number of flagella in the living condition, as the organisms are exceedingly active. Intra-cytoplasmic portion of the axostyle was not visible in the living condition, but its free portion, which is flexible and bends during movement, was often visible. To this free axostylar portion are attached minute particles of débris; whether this attachment is due to some axostylar secretion is difficult to ascertain. Occasionally, it was noted that certain individuals remained attached to the mass of débris by their free axostylar ends and could not free themselves. The cytostome is undetectable and the nucleus is also indistinct in the living condition.

In appropriately fixed and stained preparations, the body appears to be irregularly pyriform, with its one side more convex than the other. The periplast is distinct. At the anterior end there often appears a cleft or groove situated on the more convex border of this end and this represents the cytostome of the organism (Pl. 3, fig. 1), while on its left there is a dent at its anterior extremity through which all the flagella appear to come out (Pl. 3, fig. 2). The presence of this groove affects the symmetry of the organism which is approximately bilateral. The four anterior flagella usually adhere together and can be made out only by counting their free extremities. Specimens with well-spread-out flagella were also encountered and it was from these that one could make out the four anterior flagella which were equal in length and slightly longer than the body. All the five

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[1] The generic name *Trichomastix* was pre-occupied by an insect, hence Kofoid and Swezy (1915) introduced the name *Eutrichomastix* as a substitute for it.

flagella arise from a single basal granule which normally remains apart from the nucleus though in certain specimens it was seen attached to the nuclear membrane (Pl. 3, fig. 3): this latter condition is caused, in all probability, by shrinkage of specimens during the preparations of smears. The basal granule stains deep-pink with Giemsa and black with iron-alum haematoxylin. There is no rhyzostyle. The axostyle originates distinctly from the basal granule and during its course towards the posterior end bends round the nucleus but never pierces it. The axostyle consists of a deeply staining fibre or rod (Achsenstab) which stains pink with Giemsa. In haematoxylin-stained specimens it assumes a deep tint while in certain cases it presents a hyaline appearance with minute granules inside it (Pl. 3, fig. 4). The free portion of the axostyle is elongated and has a pointed end; in certain specimens it seems to be curved. There is no protoplasmic sheath around the free portion of the axostyle.

The anteriorly located nucleus is spherical or slightly ovoid in shape and has a thin nuclear membrane and a centrally placed endosome, surrounded by a faintly staining homogeneous area.

The cytoplasm is vacuolated and contains inclusions chiefly of bacterial nature. In a few specimens the cytoplasm was seen to contain coccus-like bodies, which probably belong to the genus *Sphaerita* (Pl. 3, figs. 4 and 6).

Although very few stages showing multiplication were seen but multiplication seems to take place by longitudinal fission. The basal granule divides into two daughter granules which move apart, one bearing two flagella and the other three (Pl. 3, fig. 5). It appears, therefore, that in subsequent stages three new flagella on one side and two new ones on the other develop from the daughter basal granules thus making five flagella for each daughter individual. Meanwhile, the nucleus divides into two and this division is followed by a longitudinal cleft at the anterior portion of the body, which deepens and divides the organism into two daughter individuals.

Encystment: The body of the flagellate becomes rounded (Pl. 3, fig. 6) and the flagella are lost,[1] but the basal granule persists (Pl. 3, fig. 7). At first a thin cyst-wall is secreted and in earlier stages the nucleus with its endosome is quite distinct, but the cyst-wall thickens later, and the basal granule divides into two parts which separate, move away from each other, and come to lie on the opposite sides of the spherical cyst. Between these two daughter granules extends a centrodesmose (Pl. 3, fig. 8).

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[1] Mackinnon (1915) has given a series of sketches of the encystment of a trichomastigine, *Eutrichomastix* (*Trichomastix*) *trichopterorum* or *Tetratrichomastix parisii* (?), and has described that the flagella adhere to the body while rounding takes place and persist in fully formed cysts. I could not, however, detect the adherence of the flagella or their persistence in the cysts.

The cytoplasm of the cyst is clear. Further stages of division were not available.

Measurements:—

(*a*) Length of the body exclusive of the free axostylar portion $5{\cdot}6\mu$–$10{\cdot}3\mu$; average for 50 specimens $7{\cdot}8\mu$.

(*b*) Width of the body at maximum diameter $2{\cdot}8\mu$–$5{\cdot}6\mu$; average for 50 specimens $4{\cdot}6\mu$.

(*c*) Length of the free axostylar portion $1{\cdot}5\mu$–$4{\cdot}2\mu$; average for 50 specimens $3{\cdot}2\mu$.

(*d*) Diameter of the nucleus $1{\cdot}4\mu$–$2{\cdot}7\mu$; average for 50 specimens $2{\cdot}3\mu$.

(*e*) Cysts $4{\cdot}8\mu$–$6{\cdot}3\mu$.

PREVIOUS WORK.

Mackinnon (1913) instituted the new sub-genus *Tetratrichomastix*, and described *T. parisii* as the type species of this sub-genus, which possesses an 'axostyle and five free flagella, four anteriorly, and one posteriorly directed'. *T. parisii* was found in the intestine of the grub of *Tipula*. In a later communication (1915) she described spherical cysts, 4-5μ in diameter, of a trichomastigine, but she was not sure whether these cysts belonged to *Eutrichomastix* (*Trichomastix*) *trichopterorum* or *T. parisii*. Becker (1926) described *T. citelli* from the caecum of the ground-squirrel *Citellus tridecemlineatus*. He regards *Tetratrichomastix*, without giving any reason, to be a 'sub-genus of *Eutrichomastix*'. Young (1935) raised the sub-genus *Tetratrichomastix* to the generic rank on the ground that 'The number of flagella is an important morphological feature and since *Eutrichomastix* possesses three anterior flagella and the sub-genus *Tetratrichomastix* four anterior flagella, it seems desirable to raise the latter to the generic rank'. He described *T. blattidarum* from the posterior part of the intestine of different species of cockroaches, namely, *Blatella germanica*, *Blatta orientalis* and *Periplaneta americana*, and could successfully cultivate this organism in haemoglobin-saline medium. Kowalczyk (1938) described *T. mackinnoni* from the intestine of the larva of the Japanese beetle, *Popillia japonica*. These are the only reports, so far as I am aware, of the species of this genus recorded up to date.[1]

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[1] Sangiorgi (1917) cultivated a flagellate from human faeces and named it *Tetratricomastix intestinalis*. But this flagellate had only four flagella (not five) and has been regarded by Dobell and O'Connor (1921) to be 'at all events, probably a coprozoic species of *Tetramitus* and not an intestinal flagellate'. Hence, Sangiorgi's flagellate is simply a misnomer and has nothing to do with the genus *Tetratrichomastix*.

During recent years, much attention has been paid to the study of trichomonad flagellates in order to find out the most reliable characters for classifying these organisms, but there is still little agreement on this point. Certain authors, as for example, Parisi (1910) and Young (1935), attach much importance to the flagellar apparatus only. Thus Parisi believes that the number and mode of attachment of the flagella are real points of systematic value, and on this basis he has resolved the genus *Trichomonas* Donné into three sub-genera, namely (*a*) *Trichomonas, sensu strictu*, with three anterior flagella and an undulating membrane, (*b*) *Tetratrichomonas* with four anterior flagella and a trailing flagellum, and (*c*) *Trichomastix*[1] with three anterior flagella and a trailing flagellum, without an undulating membrane. Mackinnon (1913) made a further addition to this list by describing the sub-genus, (*d*) *Tetratrichomastix*, which, according to her, bears exactly the same relation to *Eutrichomastix* (*Trichomastix*) as *Tetratrichomonas* does to *Trichomonas*.

Contrary to Parisi's suggestion, there are other authors who hold that the flagellar apparatus is not of paramount importance in classification. Thus, Doflein (1916) believed that *Trichomonas* and *Eutrichomastix* are varieties of the same form: in the former the trailing flagellum remains attached to the body forming an undulating membrane, while in the latter it is cleft apart forming the 'schleppgeissel'. Doflein's view is shared by Prowazek (1904), Dobell (1909), Martin and Robertson (1911), Reichenow (1918, 1920), Chatton (1920) and others, though other workers, for instance, Wenyon (1926), Bishop (1931), Das Gupta (1935, 1936), and also Dobell (1907) hold that *Eutrichomastix* is a distinct genus;[2] the latter group of workers thus regard the flagellar apparatus to be of diagnostic value.

Alexeieff (1911) gives five characters, viz., (1) the condition of the undulating membrane, (2) the dimensions of the axostyle, (3) the distribution of the extra-nuclear siderophilic granules, (4) the structure of the nucleus, and (5) the presence and form of the parabasal body, which when applied to the study of adult forms should form a reliable basis for classifying the species of *Trichomonas*. Mackinnon (1913) expresses her scepticism with regard to the characters laid down by Alexeieff as they are liable to fluctuation, particularly in those forms which happen to parasitize more than one kind of host. Further, she writes, 'it is by no means always easy to decide which is the typical adult form'. In support of her arguments she has referred to the case of *Eutrichomastix* (*Trichomastix*) and has asserted that 'two of the said characters, i.e. the parabasal body

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[1] *Eutrichomastix—vide* foot-note, p. 2, p. 28.

[2] My observations on the intestinal flagellates of *Varanus monitor* (paper in preparation) also lead me to believe that *Eutrichomastix* is a separate genus.

and the condition of the undulating membrane, are necessarily absent, and this renders the species determination on morphological grounds increasingly uncertain'. Moreover, she has laid stress on the degree of the intensity of staining, which may give a false conspectus of the form under observation, and may lead a worker to regard it as belonging to a different species. For instance, she could distinguish two forms of *T. parisii*, viz., (*a*) with a darkly staining nucleus, which is compact and rich in chromatin blocks and is often surrounded by a halo of small, siderophilous, bodies (ingested bacteria?), and (*b*) with a relatively large, faintly staining nucleus, poor in chromatin masses and with much vacuolated cytoplasm staining relatively intensely. Although these forms never occurred side by side in the same preparation she has refrained from designating them as different species and is 'strongly of the opinion that the degree of intensity of the staining must be taken into account'. Personally, I am of opinion that besides the morphological characters as defined by Alexeieff, and the intensity of staining reactions (as suggested by Mackinnon), the nature of the flagellar apparatus and its relations with the nucleus are the most valuable criteria for the classification of trichomonad flagellates, and in this I agree with the suggestion of Parisi and Young.

SYSTEMATIC POSITION.[1]

The presence of five flagella, four directed anteriorly and one posteriorly, and the absence of an undulating membrane at once determine the position of this flagellate as belonging to the genus *Tetratrichomastix* Young, 1935. In the shape and apparent bilateral symmetry of the body, and in the length of the free portion of the axostyle, *Tetratrichomastix hegneri* resembles *T. citelli* Becker, 1926, but differs from the latter in several characters; for example, in *T. citelli* the basal granule is attached to the nuclear membrane, the axostyle traverses the nucleus, the posteriorly directed flagellum and the anteriorly directed flagella are smaller in size as compared with the body length and the cytoplasm is less vacuolated (see Becker's figs. 16 and 18), whereas in *T. hegneri* the basal granule normally remains apart from the nuclear membrane, the axostyle never traverses the nucleus, the trailing flagellum and the anteriorly directed flagella are proportionately longer than the body and the cytoplasm is comparatively more vacuolated. In the length of its body, in the proportion of the lengths of the flagella as compared to the body-length and in the nature of its cytoplasm *T. hegneri* approximates *T. mackinnoni* Kowalczyk, 1938, but differs from the latter in the structure of the nucleus (in *T. mackinnoni* there

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[1] Most of the descriptions given by the respective authors are very meagre, hence comparison has been made through their drawings.

is no endosome or endobasal body), in the relation of the basal granule to the nucleus (in *T. mackinnoni* the basal granule remains attached to the nuclear membrane), in the presence of a distinct periplast, and in the absence of a protoplasmic sheath round the free portion of the axostyle. In the structure of the nucleus mostly, in its relation to the basal granule, in proportion of the lengths of the flagella as compared to the body-length and in the nature of the cytoplasm, *T. hegneri* resembles *T. blattidarum* Young, 1935, but the latter differs from the former in the presence of a poorly developed axial fibre, measurements of the body and in the presence of two basal granules, from one of which arise the two anterior flagella and from the other arises the trailing flagellum along with the next two anterior flagella, as is evident from Young's single figure. *T. hegneri* differs also from *T. parisii* Mackinnon, 1913, in its shape, which in the latter is broadly pyriform or globular, in the structure of the nucleus (*vide supra*), in measurements of the body, and in the nature of the axostyle, which is poorly developed and is enclosed in a protoplasmic sheath, as is evident from Mackinnon's figures 30, 31, 32. Moreover, from her figures 30 and 32 it can be easily made out that there are two basal granules, from one of which arise the four anteriorly directed flagella and from the other arises the 'schleppgeissel', and in this respect also *T. hegneri* differs from *T. parisii*. In the light of these facts I consider *T. hegneri* to be a new species of the genus *Tetratrichomastix*.

The table on p. 33 shows the measurements, habitat, host, locality, etc., of the various species of *Tetratrichomastix*.

Summary.

(1) The genus *Tetratrichomastix* is recorded for the first time from India, and a detailed account of *T. hegneri*, sp. nov., is given.

(2) *Tetratrichomastix hegneri*, sp. nov., is the second species of this genus to be recorded from a vertebrate host, the first being *T. citelli* Becker, 1926, from the ground-squirrel *Citellus tridecemlineatus*.

(3). A comparison of the hitherto known species of *Tetratrichomastix* is appended in a tabular form.

Acknowledgments.

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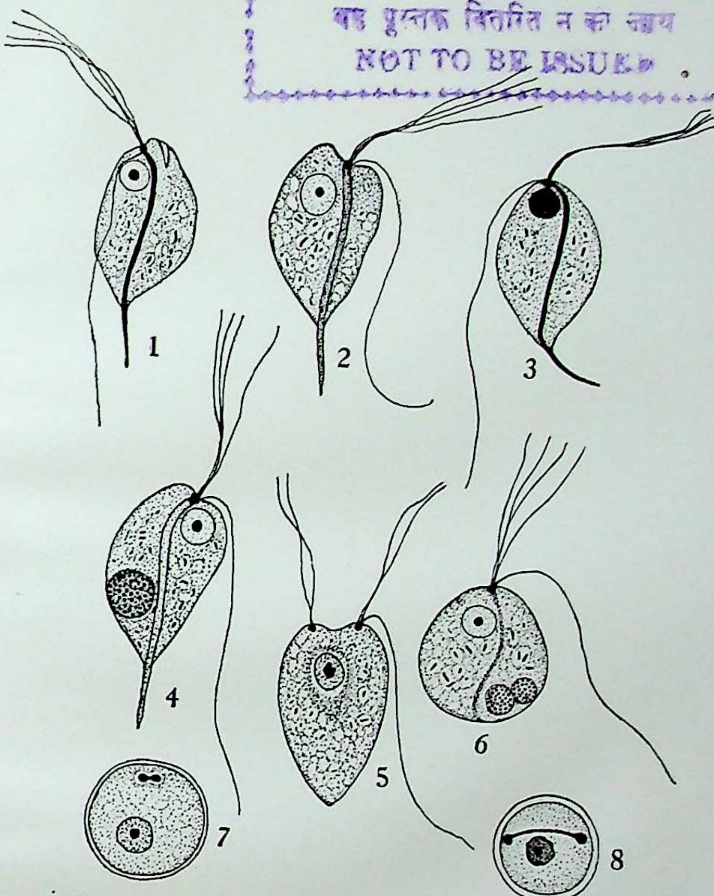
TABLE.

Name.	Length of the body exclusive of free axostylar portion.	Nature of axostyle and length of free axostylar portion.	Width of the body.	Shape and size of the nucleus.	Cytostome.	Cyst.	Habitat.	Host.	Locality.
T. parisii Mackinnon, 1913.	8μ–12μ.	Poorly developed; measurement not given.	4μ–7μ.	Round or oval; measurement not given.	Not visible.	4μ–5μ.	Intestine.	Tipulid larvae.	England.
T. citelli Becker, 1926.	7μ–13μ.	Distinct; 2μ–4μ.	....	Round.	Indistinctly seen.	....	Caecum.	*Citellus tridecemlineatus.*	N. America.
T. blattidarum Young, 1935.	8μ–14μ; avg. 9μ.	Slender; $1{\cdot}5\mu$–3μ; avg. 2μ.	4μ–8μ; avg. $5{\cdot}5\mu$.	Round.	....	....	Posterior part of intestine.	*Blatta orientalis; Blatella germanica; Periplaneta americana.*	N. America.
T. mackinnoni Kowalczyk, 1938.	5μ–10μ; avg. $7{\cdot}2\mu$.	Well-developed; 1/2–1/3 of body-length.	4μ–9μ; avg. $5{\cdot}7\mu$.	Round.	Visible.	....	Intestine.	*Popillia japonica.*	N. America.
T. hegneri, sp. nov.	$5{\cdot}6\mu$–$10{\cdot}3\mu$; avg. $7{\cdot}8\mu$.	Well-developed; $1{\cdot}5\mu$-$4{\cdot}2\mu$; avg. $3{\cdot}2\mu$.	$2{\cdot}8\mu$–$5{\cdot}6\mu$; avg. $4{\cdot}6\mu$.	Spherical or slightly ovoidal. $1{\cdot}4\mu$–$2{\cdot}7\mu$; avg. $2{\cdot}3\mu$.	Visible.	$4{\cdot}8\mu$–$6{\cdot}3\mu$.	Intestine and rectum.	*Rana limnocharis.*	Mukteswar-Kumaun, U.P., India.



(All *Camera lucida* drawings drawn to scale : *ca.* 1400.)

Tetratrichomastix hegneri, sp. nov.

Figs. 1, 2, 3 and 4 show trophozoites; fig. 3, a trophozoite stained with Giemsa; fig. 4, an individual invaded by *Sphaerita*; fig. 5 shows a dividing individual; fig. 6, a rounded individual with two specimens of *Sphaerita*; figs. 7 and 8, cysts.

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ARTICLE No. 5.

Racial Affiliation of the Gonds of the Central Provinces.

By D. N. MAJUMDAR.

The Gonds of the Central Provinces are an interesting people. Culturally they are superior to the wild tribes of India that live in the secure asylums of hills and fastnesses. They have from very early times come in contact with other racial groups, yet they have more or less maintained their cultural integrity. The record of their achievements forms the theme of their folk songs which are still sung in the fields and farms of Chattisgarh, in the Gond villages, that are scattered all over the central belt of India. The power and influence they wielded during the medieval period of Indian history survive still in various parts of the Gond country as not a few of the smaller states in these parts are ruled by families of Gond extraction.

The Gonds have been taken by some scholars as the true autochthones of peninsular India. Some have affiliated them with the pre-Dravidians of the south, while others trace them to a short long and moderately high headed type of aborigines with flat nose and thick lips. In an able survey of migrations of castes and tribes into Central India, Mr. C. S. Venkatachar discusses the problem of the Gonds (Census Report of India, 1931, Vol. I, pt. III, B, pages 60–68). 'The latter', according to him, 'may be the pre-Dravidians of the south on whom the Dravidians have imposed their language and due to some causes in the regions of north-east Madras, there must have been a large scale displacement of the tribes into the interior of the central regions.' The pre-Dravidians of which Mr. Venkatachar speaks in this connection (ibid., p. 61) are 'a dark Negroid race of low culture characterized by a physical type of very short stature, low forehead and flat face and nose'. There has been of late some support in favour of a Negrito substratum in India. Dr. B. S. Guha has drawn attention to the existence of a Negrito substratum in India (Nature, May 19, 1928, and June 22, 1929). Dr. J. H. Hutton has gone a step further, for he says, 'In any case the Negrito seems to have been the first inhabitant of south-eastern Asia. As already indicated, traces of this stock are still to be seen in some of the forest tribes of the higher hills of the extreme south of India' and similar traces, he argues, 'exists in the inaccessible areas between Assam, Burma and elsewhere' (Man In India, Vol. VII, 257–62). Dr. Eickstead does not admit the existence of the Negritoes in India (Die Rassengeschichte von Indien mit besonderer Berucksichtigung von Mysore, Zeits. Morph. Anthropol. Bd. 32, pages 77–124, 1933) and Dr. G. M. Morant has provided some statistical evidence to show that

they had little to do with the composition of Indian races. (Morant, G. M., A Contribution to the Physical Anthropology of the Swât and Hunza Valleys, J.R.A.I., Vol. LXVI, Jan.–June, 1936).[1] Whether there was or was not a Negrito race in India is not very material to our discussion as the Gonds do not possess Negrito features.

The aboriginal population of India discloses four types according to Dr. B. S. Guha (Census Report of India, Vol. I, pt. III, A, pp. LXII–LXIII). A short long and moderately high headed strain with often strongly marked brow ridges broad short face, the mouth slightly inclined forwards and small flat nose with the alae extended (1). A dark pigmy strain having spirally curved hair, remnants of which are still found among the Kadars and the Pulayans of the Perambicullan Hills (2). A brachycephalic Mongolian type constituting to-day, the main component of Assam and North Burma (3). A second Mongoloid strain characterized by medium stature high head and medium nose but exhibiting like (3) the typical Mongoloid characteristics of the face and the eye. This element constitutes the major strain in the population of the hills and not inconsiderably of that of the Brahmaputra valley (4).

The first of these types according to Dr. Guha is predominant among the aboriginal population of central and southern India and also have penetrated into the lower strata of the Indian caste groups. The Gonds do not wholly answer to the aboriginal type described by Dr. Guha as there are among the Gonds an appreciable number of individuals with short stature, long heads comparatively high cranial vault, faintly marked supraorbital ridges, broad short but orthognathous face with medium lips, prominent and long nose with the alae moderately spread, complexion varying from light brown to dark tawny brown, dark brown eyes and black straight or wavy hair. This type represents the bulk of the population of the peninsular and considerable portion of northern India. At one extreme this type has mixed with a lighter but dolichocephalic type in the north, and in the south, with the aboriginal type so that the various tribes and groups upper and lower in the south as well as in the north represent to-day mixed ethnic groups. The Gonds as suggested by their physical features are a mixed people. There is no Mongoloid traits among the Gonds though from cultural similarities Dr. J. H. Hutton thinks there are. (Dr. J. H. Hutton's Introduction to W. V. Grigson's Maria Gonds of Bastar).

In an earlier paper (Presidential Address, Anthropology Section of the Indian Science Congress, 1939) I compared the somatic characters of the various cultural groups in Bastar

[1] In the paper mentioned by the author, no statistical or other evidence is provided by Dr. Morant against the existence of a Negrito racial strain in India. Ed.

State of the Eastern States' Agency, and pointed out the intra-group racial variability within the State. Since then the statistical data were worked out by me in greater detail and I feel justified in presenting the results is a systematic way.

Bastar is a large State with an area of 13,725 square miles, lying between 17° 46′ to 20° 14′ N and 80° 15′ and 82° 1′ E. To the north of Bastar lie the Kankar State and the Dhamtari Tahsil of Raipur district, to the east is situated the State of Jeypore also under the Eastern States' Agency. The Godavari river forms the part of the southern boundary of the State and the Chanda district lies to the west. The central and north-western part of the State is rugged and mountainous. A plateau with an elevation of approximately, 2,000 ft. above sea level lies to the eastern part of the State running from north to south. Jagdalpur the capital of the State lies to the south of the plateau. The Indravati river which joins the Godavari after forming the southern boundary of the State, flows across the centre of the State from east to west thus partitioning it into two portions. The north-western is covered by a mass of rugged hills known as Abujmarh which affords shelter to the most primitive but the most attractive section of the population, viz. the Maria Gonds.

The ruling family of Bastar belongs to a Kshatriya clan. The founder of the family was one Annam Deo who belonged to the royal family of Warrangal. On the advice of his tutelary goddess he fled from Warrangal to escape the pursuit of the Mahomedan invaders. After traversing a long trek through the inaccessible areas followed by a mysterious jingle of bangles supposed to be the direction of the goddess who had instructed him through a dream not to stop unless the jingle disappeared and not to look backward so long the sound was audible, suddenly stopped on the other side of the Pairi river. The jingle of the bangles was silenced on account of noise caused by the wading of his followers through the water bed of the river and Annam Deo looked backward in suspense. The sound now finally disappeared and the river to-day forms the boundary between Kankar and Bastar States. The hereditary high priest of the temple accompanied him, so also some representative Rajput families and their camp followers. With them also was brought the sword of Dhanteswari which in the new shrine dedicated to her in Bastar provides the symbol of the goddess and even to-day the sword is worshipped in the Dhanteswari temple in Jagdalpur.

The native population of the State mostly belong to the Gond group of tribes and the immigrants and foreigners who have settled down in the area appear to have freely intermixed with the indigenes. The total Gond population in India according to the census of 1891 was 1,666,764. Since 1901 and up to the 1921 census the figures of Marias, Murias, Bhattras and

Parjas were included with Gonds, yet the strength of the Gonds was only 1,714,894. According to the census of 1931, the Marias number 181,095 so that if we deduct only the figures of Marias from the total for Gonds the latter do not show any increase in numerical strength. In the Central Provinces States the number of Gonds in 1911 were 578,752. It declined to 394,685 in 1921 and still went down to 369,303 in 1931. Thus the Gonds are showing a tendency to decline numerically. The population of Bastar State, according to the census of 1931, is 524,721 (263,248 males and 261,473 females), and those following tribal religions number 3,61,920 of which 181,390 are males and 180,530 females. The vital statistics of the State show that the population of the State is increasing by 5,000 every year.

Of the native population following tribal religions the Hill Marias are the wildest of the tribes in Bastar who are also enumerated in adjoining districts, in Vizagapatam and Hyderabad where they are known as the Koyas. The Hill Marias do not seem to have entered the social economy or adopted the culture pattern of Bastar. They are still accustomed to their nomadic life in the hills and jungles and supplement their gleanings in the forests by shifting cultivation called *Dippa* and *Penda* in these parts. The Bison-horn Marias have settled down on the plateau and the plains and have been more influenced by their contacts with the higher castes in the State than their wild brethren the Marias of Abujmarh. The Murias of Kondagaon and those of Narayanpur also known as Jhorias are more advanced than the Marias. They have left their forest life long ago and their occupation of the plains and the plateau has brought them in closer contacts with the immigrants and foreign elements in the population of Bastar. The Murias of Kondagaon who are scattered on either sides of arterial roads, have developed an extremely efficient social organization among them and the dormitory institution with its complicated code of rites and rituals, its elaborate system of rules and regulations serve to maintain the tribal solidarity and integrity which would otherwise have been exposed to the disintegrating influences that usually result from such contacts. The two sections of the Murias, viz., the Kondagaon Murias and the Narayanpur Murias, the latter called Jhooriyas by Glasfurd and Jhoria by Grigson, are not different in physical features though in culture, the Narayanpur Murias seem to be more Hinduized and advanced than the Kondagaon Murias. The latter live on the plateau and on the hills and their dormitory institution is more integrated than that of the Narayanpur Murias.

Besides the Marias and Murias, there are also other important cultural groups in Bastar. The Dhruvas otherwise known as Parjas (a generic name which includes a number of tribal groups speaking Oriya but originally belonging to one or other of the tribal groups living in Bastar and the neighbouring areas)

claim a higher social status than the tribes already enumerated. They have adopted the dialect of a superior cultural group and also some of the important traits characteristic of the latter. The Bhatras are a little higher in social scale than the Parjas. They have a few subgroups which claim distinct social status as a result of Hinduization. The Hinduized Bhatras put on sacred threads and consider those who still adhere to tribal prescriptions as inferior and thus have already closed their ranks to other tribes and groups. To-day, Bhatras who still intermarry with other groups have distinct lower social status. Both the Parjas and Bhatras live by permanent cultivation. The Parjas appear to have come earlier to Bastar than the Bhatras, as they provide the priests in Bhatra villages.

The Halbas appear to be culturally a dominant group as the language of the State is Halbi and the supposed military antecedents of the Halbas give them an importance which is reflected in their attitude to the other social groups. They have mixed with the tribal groups and even to-day mixed marriages between Halbas and the other Gond tribes have not been tabued. The Dhakars are certainly superior to the Halbas and are reputed to be descendants of Kshattriya families who followed the ruling family to Bastar but it appears that they too have not escaped infusion of aboriginal blood as is evident from the practice of widow remarriage and that of *Ghaita Pani* or the auction of widows by the State authorities to rehabilitate Dhakar families originally meant to provide a *jus connubii* for them.

Although the language of the State is Halbi which is a mixed dialect of Hindi, Oriya and Marhatti and is akin to Chattisgarhi which is spoken over wide areas in the Central Provinces, the inhabitants speak the various dialects of the Gondi language. The linguistic map of Bastar will show the zones into which the State may be roughly divided. In the northern border of the State, Chattisgarhi Hindi is spoken. The greater part of the eastern border has Oriya as its principal language. In the south-east some islands of Koya dialects are found which are very similar to Maria spoken in the State. Inside the State, Parjas and Bhatras speak dialects which appear to be akin to Oriya or very much influenced by it. In the south and south-east the language is Telugu while along the western border debased form of Marhatti is spoken by a number of scattered communities. The interior of the State is inhabited by various aboriginal groups who speak their respective dialects all affiliated to the Gondi, more or less influenced by border languages in accordance with their proximity to them or the intensity of their contacts with people speaking those languages. The only representative of the Munda speaking people perhaps are the Gadabas who are a small occupational group, palanquin bearers

by profession, living east of Jagdalpur but who now have lost much of their original culture traits.

Measurements were taken on 463 individuals belonging to 9 cultural groups in Bastar, viz., Dhakars, Halbas, Bhatras, Parjas, Gadabas, Murias of Kondagaon, Murias of Narayanpur, Dandami Marias and Hill Marias. We could get measurements of 51 Muria females from Kondagaon and Narayanpur and for purposes of comparison we measured 50 Nawagharia Gonds living in Akaltara, C.P. Sixteen characters were chosen for treatment and all measurements were taken with Herman and Rickenboch's anthropometric instruments. The following measurements were recorded:—

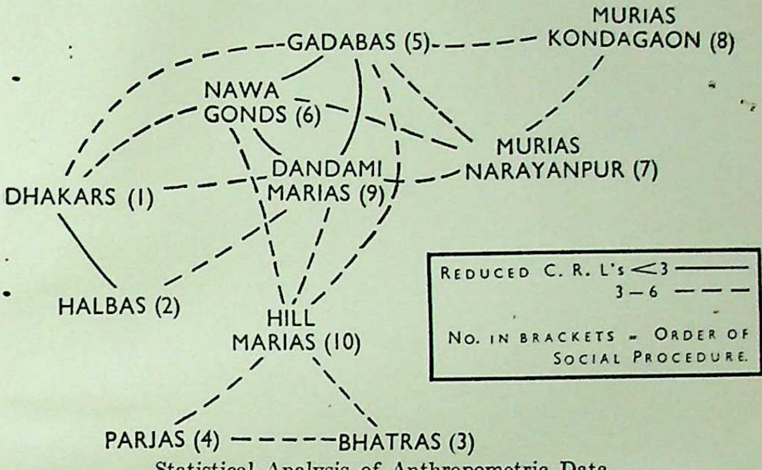
(1) Stature, (2) Span, (3) Auricular Height, (4) Maximum Head Length, (5) Maximum Head Breadth, (6) Maximum Bizygomatic Breadth, (7) Bigonial Breadth, (8) Nasal Length, (9) Nasal Width, (10) Nasal Height, (11) Orbitonasal Breadth, (12) Orbitonasal Arc, (13) Upper Facial Length, (14) Total Facial Length, (15) Nasion to Crinion, (16) Crinion to Menton.

In the case of females, span was left out for obvious reasons. Definitions of important measurements are given below. The head length was taken from the glabella to the most distant part of the occiput. Head breadth was first taken over the hair, then by parting the hair at points which gave the maximum diameter, the difference was however negligible. The facial height was taken as the distance between the nasion and the mid-point on the anterior surface of the lower jaw. The most depressed part at the root of the nose was taken as the 'nasion' for obvious difficulties in locating it. The bizygomatic breadth was measured by running the callipers backwards along the zygomatic arches until maximum reading was obtained. Nasal length was taken from the nasion to the subnasal point, i.e. at the angle formed by the septum of the nose and the upper lip. Nasal breadth was taken across the lateral surfaces of the alae 'with the nostrils deflated and the tip of the nose unwrinkled'. From the definitions above it will appear that most of the measurements are comparable to existing series. I have used nasal height for depth or elevation of the nose.

The crude data were sent to the Indian Statistical Laboratory, Calcutta, where they were calculated under Prof. P. C. Mahalanobis's supervision. My grateful thanks are due to Prof. Mahalanobis on this account. The coefficient of racial likeness crude as well as corrected were worked up at Lucknow by me with the assistance of Mr. S. P. Agarwalla, a student of mine also trained in Prof. Mahalanobis's laboratory. I am also much indebted to Dr. G. M. Morant of the Galton laboratory for the many valuable suggestions and general revision of the paper.

In computing the C.R.L. I have taken 16 characters only. But these characters are all absolute in the sense that they do not include any indical relationship, though they represent linear,

arcal and characters denoting shape and size as well. The means and standard deviations of the characters have been given in Tables 1 to 5.



Statistical Analysis of Anthropometric Data.

If we take 0–3 as intimate association, 3–9 as association and above 9 as divergence (?), we get the relationships as shown in the diagram above. It shows the alignment of the different cultural groups with respect to the Hill Marias who are the most primitive group in Bastar and shows the affiliation of the Dhakars to the other cultural groups. The Nawagharia Gonds as we have already pointed out do not belong to Bastar but they afford a basis of comparison of the data on the cultural groups of Bastar with Gonds of other parts.

The arrangement above indicates the closer affinity of the Hill Marias to the Bhatras, Parjas, Dandami Marias, Nawagharia Gonds, Gadabas and Murias of Narayanpur than to the Murias of Kondagaon, the Halbas and Dhakars. The Dhakars show intimate association with the Halbas, but also show affinity to the Murias of Narayanpur, Gadabas, Dandami Marias and Nawagharia Gonds. The association of the Dhakars with the Hill Marias, Murias of Kondagaon, Parjas and Bhatras is not very close as will appear from the values of the coefficients of racial likeness. These relations indicate a large scale ethnic miscegenation in Bastar and it may be suggested that the groups speaking the same or allied languages are more intimately related than those speaking different dialects. The Murias of Kondagaon, however, presents a difficulty, for it is well nigh certain that they belong to the same stock as the Murias of Narayanpur and cultural differences, that have been brought out between them by Grigson, do not support the theory of separate origin of these two groups.

The mean age in the case of the Murias of Kondagaon is 24·10±0·73, and the standard deviation of age is 5·24±0·51, while the corresponding values for the Murias of Narayanpur are 29·33±1·23 and 8·87±0·87. The standard deviations of the age distribution of the two groups show that the Murias of Kondagaon measured by me were a more homogeneous group than the Murias of Narayanpur and the reason was that the Murias of Kondagaon included the inmates of two dormitories and as such a certain age grade preponderated in the crowd. Otherwise it is not possible to explain such differences between them. We have already described in "Culture Contacts and Acculturation", Presidential Address, Anthropology Section, Indian Science Congress, 1939, the strong dormitory organization among the Murias of Kondagaon and this is incompatible with a large scale or free crossing of the Murias with other groups. Further corroboration of the above will be found in the low values of the standard deviations of the absolute characters.

The close affinity between the Dhakars and the Halbas, both immigrant groups in Bastar is to be expected. Also the arrangement in the diagram shows a closer correspondence with social status than with the geographical distribution of the groups. The Parjas and Bhatras though they speak Oriya or some patois with preponderating Oriya influence do not differ much from the Hill Marias, so that the racial affiliation with the latter is established. The Nawagharia Gonds are not a closed group and so also the Dandami Marias and the association of the latter with the Dhakars and Halbas may mean an intermixture which is popularly admitted in Bastar. This intermixture therefore explains the absence of an intimate association of the Dandami Marias with the Hill Marias. Gadabas do not represent a pure ethnic stock and though their dialect may be traced to Munda origin their physical features do not warrant such affiliation.

A discussion of the significance ratios provides further evidence of the inter-relation of the cultural groups as suggested by the C.R.L. method. The significance ratio is the difference of the means expressed in terms of the square root of the sum of the squares of the probable error of the means and is calculated from the formula :

$$\frac{\Delta\, m-m'}{\sqrt{(\mathrm{P.E.}m)^2+(\mathrm{P.E.}m')^2}}$$

The significance ratio is taken to determine how far on the basis of the laws of chance sample m and sample m' might have been drawn at random from a single population. Although this ratio should not be interpreted as a measure of the degree of racial difference, it may indicate how far the two samples are entitled to 'separate consideration and mutual comparison'.

The means and standard deviations of 16 physical characters for the entire series are to be found in Tables 1–7. In comparing the constants a difference greater than *three* is taken as significant, and a difference between 2 and 3 as *doubtful* and below 2 as insignificant. In Table 5 (pp. 54–56) the significance ratios are given, only values above 2 are recorded.

The Parjas appear to be the tallest group with a mean stature of 162·32±0·88, next come the Hill Marias with 162·06±0·69. The Dandami Marias are the next tall group. The Halbas and Dhakars occupy the 7th and 8th places in stature with 158·17±0·83 and 158·09±0·72. The significance ratios for stature affiliate the Hill Marias with the Parjas, Bhatras, Narayanpur Murias while they are entitled to separate consideration from the Dhakars Halbas, Gadabas, Nawagharia Gonds and Kondagaon Murias while their relations with Dandami Marias are doubtful. Unlike many areas, the mountain group is found to possess the tallest stature and better general health than the settled groups. The Dandami Marias are certainly an offshoot of the Hill Marias but they possess to-day a smaller stature than their wild brethren. The higher groups which are known to have freely mixed with the tribal people possess smaller stature compared with the latter, so that the invading groups in Bastar did not probably belong to any tall stock.

The span measurements do not tell a different tale. There is a correlation between stature and span so that the group with the highest mean stature possesses the highest span measurement. The significance ratios between the Dandami Marias and Dhakars, Gadabas and Kondagaon Murias and Halbas are doubtful. The Hill Marias differ significantly from the Dhakars, Gadabas and Kondagaon Murias but the significance ratio between them and Halbas is (2·24) indicating doubtful relationship. The Bhatras differ significantly from the Dhakars (3·90), Gadabas (3·22) and Kondagaon Murias (3·85).

From the head measurements it appears that there is a progressive lengthening of the head towards the mountain regions as is illustrated by the fact that the Hill Marias possess the longest head (184·57), next to them come the Bhatras with (184·43) and then the Kondagaon Murias (183·58). The Bhatras are immigrants while the Kondagaon Murias inhabit hilly tracts. The mean headlength for the Gadabas and Dhakars are (182·77) and (182·26) respectively. The Halbas possess the lowest mean headlength (179·82) which compares favourably with that of the Dandami Marias (180·50). There is no doubt that the Halbas are more mixed than the Dhakars and their admixture with the Dandami Marias is perhaps responsible for the lowering of the mean head length for the latter as well. The mean head breadth for the mountain groups, viz. the Hill Marias and Kondagaon Murias are less than those of the Halbas, Dhakars and Nawagharia Gonds who are plains people. The Parjas have the

highest mean head breadth (140·48), then come the Halbas with (139·82) and Bhatras (138·94). The cephalic indices (calculated from the mean head length and head breadth of the groups) confirm the suggestions already made above, for the Hill Marias (74·20), Kondagaon Murias (73·04) and Gadabas (74·27) possess an index below 75, the Bhatras (75·33), Dandami Marias (75·96), Dhakars (75·17), Nawagharia Gonds (75·31) possess an index between 75 and 76, while the Parjas (77·79) and Halbas (77·75) show a tendency to brachycephaly. The Gadabas have mixed with the Murias, for to-day, the Gadabas do not consider themselves different from the Murias though linguistically they may be affiliated to the Munda speaking groups of Chota-Nagpur in Bihar. The cephalic index of the Munda tribes is not higher than 75 and even if the Gadabas have mixed with the Murias there has not been any change in the value of the index. The Dhakars and Halbas as well as Parjas and Bhatras appear to have been originally mesocephalous or brachycephalous and their mixture with the indigenous groups who are dolichocephals may have contributed to a pronounced mesocephaly in their head form. The Muria females possess a mean cephalic index of 74·48 indicating a close approximation to the Muria males.

In the Bizygomatic measurement, significant ratios are found between Kondagaon Murias and Bhatras (4·10), Kondagaon Murias and Hill Marias (3·88) and Kondagaon Murias and Nawagharia Gonds (3·08). There is little difference between other groups and if there is, it is at best doubtful. The Bhatras have the highest mean Bigonial breadth (100·59) and the Murias of Kondagaon the lowest (94·46). The significance ratio between them is 6·88. There is no significant difference between other groups.

The nasal length cannot be explained in terms of geographical environment, for although the Dhakars (46·00) and Halbas (46·53) possess longer nose, the mean nasal length of the Hill Marias is 46·16. The Kondagaon Murias have the lowest mean nasal length (43·19) and as such there is significant difference between them and the Dhakars (5·62) and Gadabas (3·88), the Halbas (7·06), the Bhatras (5·44) and the Dandami Marias (4·22). If we exclude the Kondagaon Murias, there is not much difference between other groups with regard to this character. In nasal breadth, the highest mean value is given by the Bhatras (39·09), and the Hill Marias, Gadabas and Parjas have a mean nasal breadth between 38 and 39. The nasal index is usually a measure of social status in India and this is corroborated by the values of nasal indices obtained in Bastar. The Dhakars have the lowest mean nasal index (77·91) and the Halbas follow the Dhakars closely with (79·28). The Kondagaon Murias have the highest nasal index (85·52), the Gadabas (84·37), the Dandami Marias (83·62) and the Hill Marias (83·03). The Bhatras and Parjas possess a high mean nasal index, the former 85·14, the

latter 83·79 which are higher than that of the Hill Marias. Thus except the Kondagaon Murias, there appear to be two strains: one represented by the Dhakars and Halbas and the other by the Bhatras and Parjas and the rest of the groups are intermediate in type between these two extremes. It must be noted here that the difference between the various cultural groups is not such as to warrant the suggestion that they belong to different ethnic stocks, particularly this is true of tribal groups, but it shows that although the Dhakars and Halbas have ratained their social status they have considerably mixed with other groups which fact has certainly influenced the nasal indices of other groups.

The auricular height and nasal height do not give any new information as there is no striking significance ratios between the groups. In orbito-nasal breadth, the Hill Marias differ significantly from the Murias and Dandami Marias, the Bhatras from Kondagaon Murias, the Parjas from the Kondagaon Murias. The Dhakars do not differ from any of the other groups in this character except from the Bhatras (3·22). In orbito-nasal arc the Bhatras have significant ratio with Kondagaon Murias (5·53) and Narayanpur Murias (5·04) while the ratio between Kondagaon Murias and Parjas, Nawagharia Gonds, Hill Marias is also significant.

In total facial length, there is no striking difference between the groups and the only significant difference exists between the Hill Marias and Kondagaon Murias (3·19) also between Hill Marias and Nawagharia Gonds (3·93). The Bhatras have a significant ratio of (3·29) with Nawagharia Gonds. In upper facial length significant difference is found between Dandami Marias and Dhakars (3·47), Dandami Marias and Kondagaon Murias (3·11), between Dhakars and Bhatras (3·19). The other ratios are insignificant or doubtful.

We have already interpreted the significant differences found to exist between the various groups of Bastar on the basis of the study of the dispersal values of the significant ratios. It appears that the various groups measured do not differ much from one another. Except between the Kondagaon Murias and Bhatras (mean significant ratio 3·88), between the former and the Parjas (Mean S.R. 3·23) and also the Hill Marias (M.S.R. 3·02) there is no striking significant ratios between other groups as will appear from the calculated mean significant ratios in the Tables. Most of the mean significant ratios fall below unity as for example between Halbas and Nawagharia Gonds (0·69), Halbas and Parjas (0·72), Parjas and Hill Marias (0·67), Narayanpur Murias and Kondagaon Murias (0·77), Narayanpur Murias and Nawagharia Gonds (0·94), Parjas and Dandami Marias (0·91), Gadabas and Dhakars (0·88), Halbas and Dhakars (0·54), Gadabas and Narayanpur Murias (0·71) and Gadabas and Nawagharia Gonds (0·14), Gadabas and Parjas (0·77). About 13 of the

relations show mean significant ratios between 1 and 2 and only 4 show mean significant ratios between 2 and 3.

The Table below will give an idea about the respective distance of the cultural groups with respect to the indical characters (cephalic and nasal).

Name of the group.	Cephalic index.	Name of the group.	Nasal index.	Order of social precedence in the state.
Kondagaon Murias	73·04	Kondagaon Murias	85·52	(1) Hill Marias.
Hill Marias	74·20	Bhatras ..	85·14	(2) Dandami Marias.
Gadabas ..	74·27	Gadabas ..	84·37	(3) Gadabas.
Narayanpur Murias	74·42	Parjas ..	83·79	(4) Murias Kondagaon.
Muria (Fem.)	74·88			
Dhakars ..	75·17			
		Dandami Marias	83·62	(5) Murias Narayanpur.
Nawa. Gonds	75·31	Hill Marias ..	83·03	(6) Parjas.
Bhatras ..	75·33	Nawagharia Gonds	81·49	(7) Bhatras.
Dandami Marias	75·96	Narayanpur Murias	81·12	
		Muria Females	80·96	
Halbas ..	77·75	Halbas ..	79·28	(8) Halbas.
Parjas ..	77·79	Dhakars ..	77·91	(9) Dhakars.

The Nawagharia Gonds of C.P. should be placed between Bhatras and Halbas in the Table above. The Hill Marias, Murias both of Kondagaon and Narayanpur and Gadabas, all are dolichocephals, the Bhatras, Parjas, Halbas, Dhakars, Nawagharia Gonds and Dandami Marias are mesocephalous. The Halbas and Dhakars have nasal indices of 79·28 and 77·91 respectively, all the rest have their nasal indices between 80 and 86. It appears that although the tribal groups are not found to follow the order of social precedence with respect to the indical characters it is interesting that the Halbas and Dhakars, the two high castes in Bastar have maintained their social distance from the tribal groups. The intra-tribal social distance is more or less artificial as it depends on the proximity of the tribal groups to the castes. The economic interdependence of the tribal groups and higher castes have brought some of these tribes into close association with the castes which have provided them social status and a place in the social hierarchy of the state. Though the higher castes have maintained their social precedence, their physical type has undergone considerable change and to-day thin partition divides them from the tribal stock.

So far as the indefinite characters are concerned, the differences between the various groups in Bastar are not easily discernible. The Parjas are the tallest among these, their complexion varies from brown to dark, the face is slightly prognathous and the chin receding but no traces of epicanthric fold were found in any individual. Compared to other cultural groups, the Parjas appear to have some distinct ethnic traits, with the Bhatras as the closest of their kins. The Bhatras however do not show much of prognathism or receding chin and on the whole they conform to the general type in Bastar, though individuals among the Bhatras bear more close similarity to the Parjas than to Dhakars or Marias. The Bhatras do not recognize the Parjas as their kith and kin though the latter would unhesitatingly affirm their close relationship with the former. The Hill Marias are tall, handsome and graceful. Some possess a light brown complexion and few of them would answer to the aboriginal description. The hair is plentiful on the face and scalp, the limbs are well proportioned and give the idea of great power. The Dandami Marias have a variety of features in them and often it is difficult to tell a Dandami Maria from a Halba or even a Dhakar but they certainly differ from the Parjas, the chin is well developed, the nose prominent and forehead vertical. The Maria women, Hill as well as Dandami, have finer features than those possessed by the women among the Parjas. The Murias of Kondagaon as well as of Narayanpur resemble the Marias but the latter are more akin to the Hill Marias than the Murias of Kondagaon. There is hardly much to choose between the women of the two sections of the Murias and it is possible that settled life among the Murias of Narayanpur has something to do with their general appearance.

The Gadabas are a problem. In appearance they do not differ from the Murias. They have a dark complexion but brown skins are pretty frequently found among them. The eyes are large and expressive, the nose thin and well developed but the hair is less plentiful than among the Marias or Dandamis, the cheek bones are a little more prominent among them than among the Murias or Marias. Whatever be their origin, to-day they have lost their ethnic identity and are not different from the Murias from whom they would freely take food and water.

The Halbas and Dhakars are closely related, though the Dhakars as a caste possess better features. The complexion varies from tawny brown to pale brown and persons with fair complexion are not rare among them. The forehead is high and vertical, the nose prominent though not very high, the eyes are dark brown and black. On the whole their features are more regular than those of any other group and compare favourably with those of the Kshattriyas in other parts of Chattisgarh. But frequently one meets with Dhakars whose features do not

affiliate them with the description given above and it is perhaps true that nowhere the effects of intermixture are more evident than in Bastar which may be called the melting pot of races.

The results of 16 measurements on 564 persons indicate that there is a correspondence between social types and ethnic types. On the whole the lower the cultural stage, the longer the head and flatter the nose. The Dhakars and Halbas represent the higher castes in Bastar and they possess lower nasal indices than other groups. The difference between the groups are not very wide and that is why the mean significance ratios between them are not at all striking. They may all be taken to represent one ethnic type and with the exception of Dhakars all the other groups answer to a common racial type. This may be called the Gond type as comparison of the racial traits of Bastar Gonds with those of the Nawagharia Gonds does not indicate any great divergence of types. Whether we call this type Gondide or Proto-Mediterranean or Mediterranean the historic Gonds did not belong to the Australoid type we find in the aboriginal population of India, in Chota-Nagpur and elsewhere. The suggestion that the Maria Gonds may belong to the Naga stock which is inferred on the basis of alleged similarity of culture between them and the possession of Mongoloid features by individual Marias is interesting no doubt but extremely hypothetical.

Two alternative explanations suggest themselves. Either the ethnic types that have contributed to racial miscegenation in Bastar are not widely divergent, so that the Bastar type though a mixed one answers to the descriptions both of the Dhakars and Gonds, or the Dhakars and Halbas who represent the higher castes in the State have mixed to produce an intermediate type characterized by mesorhine noses and mesocephalic heads, though originally they were brachycephals and mesorrhine. This latter explanation is plausible in view of recent knowledge about the social and biological effects of race crossing. 'As far as can be ascertained', writes J. C. Trevor, 'from the best evidence available, the cross results in a nearly perfect blending of average values, determined by the proportions in which the parent populations have mixed.' These results are not perhaps genetically surprising if the parent populations are themselves highly heterozygous and variable. The variabilities of the crossed series therefore are not necessarily greater than those of the parent populations and if we pin our faith on the variability alone, to determine the purity and homogeneity of the samples, it will give us results which cannot very well be substantiated. On the basis of the arguments given above it is no wonder that the Dhakars and Halbas represent an intermediate type between the tribal type in Bastar and a type which may be ancestors to the Dhakar and Halba type characterized by brachycephaly, medium stature with flattened occiput but having also high

head, short orthognathous face, long and often pitched nose, light brown complexion, dark straight hair and dark brown eye colour, a type corresponding to Dr. Guha's B element in the Indian population (Census of India, Vol. I, Pt. III, page lxii).

An interesting example of the formation of cultural groups, the process by which tribes transform themselves into castes is found in Bastar. Grigson in his book on the Maria Gonds of Bastar has referred to this cultural transition. He writes that a large number of persons returned as members of the Hindu functional castes, the graziers, potters, fishermen, weavers, blacksmiths and others, are in reality members of the primitive tribes speaking their language and only differentiated from them by their occupation. There is nothing in their appearance to distinguish these persons from other aborigines of the area, they follow their tribal religions whether enumerated as such or as Hindus.

I measured a group of 35 Kurukhs of Chitrakot who are fishermen and live mostly by fishing in the Indravati river. A comparison of differences of means and standard deviations in terms of their standard errors of two series of measurements on the Kurukhs and Hill Marias indicate very little divergence between the two samples. The constants for the means of 16 absolute characters when compared give all values less than 2 except in the case of one nasal measurement, viz. nasal height which is 2·03. The nasal height is a delicate measurement and such small difference in value may be ignored. In standard deviations also except for the nasal breadth (2·26) and nasal height (2·90) all the other characters do not show any significant difference. Considering all these characters it appears that for all practical purposes the two samples (Kurukhs and Hill Marias) may be taken to represent the same population. The cephalic index of the Hill Marias is 74·20, nasal index 85·52 and stature 162·06 while corresponding figures for the Kurukhs are 74·50, 84·20 and 161·54. The result, however, should be regarded as extremely significant as such comparisons may lead to the identity of tribal groups with castes thereby explaining the transition of tribes into castes.

TABLE 1.

Comparative Indices for series of Bastar State, Males and Females.

	Cephalic Index.	Nasal Index.	Orbito-Nasal Index.	Total Facial Index.
Murias of Kondagaon ..	73·04	85·52	110·19	89·98
Murias of Narayanpur	74·42	81·12	109·70	90·21
Gadabas	74·27	84·37	110·20	89·09
Hill Marias ..	74·20	83·03	109·60	90·09
Dhakars	75·17	77·91	109·91	89·83
Halbas	77·75	79·28	110·38	90·58
Parjas	77·77	83·79	110·00	90·04
Bhatras	75·33	85·14	111·55	89·61
Nawagharia Gonds ..	75·31	81·49	111·89	87·83
Dandami Marias ..	75·96	83·62	110·30	89·95
Muria Females ..	74·88	80·96	108·32	88·59

TABLE 2.

*Mean Age and Standard Deviation (with Standard Errors) for groups of Bastar Males, one group of females and one of C.P. Gonds.**

	(54) Bhatras.	(50) Dan-dami Marias.	(50) Dhakars.	(51) Halba.	(51) Hill Maria.	(51) Muria Nara-yanpur.	(52) Muria Konda-gaon.	(50) Nawa-gharia Gonds.	(50) Parjas.	(52) Muria Females.	(52) Gadaba.
Mean Age	36·70 ±1·13	29·46 ±1·24	35·66 ±1·28	37·92 ±1·19	31·33 ±1·12	29·33 ±1·23	25·10 ±0·73	33·20 ±1·61	30·38 ±1·25	33·69 ±1·30	35·42 ±1·04
Standard Deviation ..	8·34 ±0·80	8·77 ±0·88	9·06 ±0·91	8·49 ±0·84	7·98 ±0·79	8·87 ±0·87	5·24 ±0·51	11·40 ±1·14	8·85 ±0·88	9·34 ±0·92	7·49 ±0·73

* In all cases the ages were estimated by the observer with the assistance of a few elders of the villages concerned.

TABLE 3.

Comparative Means for series of Bastar State Males (with Standard Errors), one group of C.P. Gonds and one female group (from Bastar).

	Dandami Marias (50) ♂	Bhatras (54) ♂	Dhakars (50) ♂	Gadaba (52) ♂	Halba (51) ♂	Hill Maria (51) ♂	Muria Nara-yanpur (52) ♂	Muria Konda-gaon (52) ♂	Gonds Nawa-gharia (50) ♂	Parjas (50) ♂	Muria Females (52) ♀
Stature	159·48	160·91	158·17	158·04	158·09	162·06	160·61	157·79	158·74	162·32	147·93
	±0·86	±0·79	±0·83	±0·81	±0·72	±0·69	±0·74	±0·68	±0·74	±0·88	±0·58
Span	172·70	173·63	168·28	169·44	170·84	173·76	171·54	169·08	171·76	174·22	..
	±1·09	±0·84	±1·09	±0·79	±0·93	±0·91	±1·03	±0·83	±0·94	±1·20	..
Head Length ..	180·50	184·43	182·26	182·77	179·82	184·57	182·37	183·58	182·42	180·58	176·46
	±1·00	±0·75	±0·83	±0·80	±1·04	±0·73	±0·72	±0·85	±0·74	±0·95	±0·82
Head Breadth ..	137·12	138·94	137·02	135·75	139·82	136·96	135·73	134·10	137·38	140·48	131·44
	±0·73	±0·65	±0·64	±0·76	±0·76	±0·56	±0·52	±0·30	±0·61	±0·71	±0·57
Auricular Height ..	12·80	13·0	12·67	12·89	12·93	13·02	13·03	12·79	12·81	13·09	12·67
	±0·08	±0·07	±0·08	±0·08	±0·10	±0·09	±0·07	±0·10	±0·08	±0·07	±0·09
Nasal Length ..	45·30	45·91	46·00	45·13	46·53	46·16	45·46	43·19	45·72	45·54	42·98
	±0·42	±0·40	±0·44	±0·36	±0·55	±0·34	±0·42	±0·40	±0·41	±0·53	±0·45
Nasal Breadth ..	37·88	39·09	35·84	38·08	36·88	38·33	36·98	36·94	37·26	38·16	34·80
	±0·34	±0·34	±0·34	±0·34	±0·46	±0·35	±0·32	±0·28	±0·34	±0·39	±0·32
Nasal Height ..	20·56	21·96	19·84	20·46	21·12	20·24	18·81	18·96	20·04	20·80	17·77
	±0·28	±0·26	±0·22	±0·16	±0·28	±0·29	±0·22	±0·22	±0·24	±0·22	±0·21
Bizygomatic Breadth ..	128·82	130·41	128·48	128·96	128·61	130·63	128·08	127·13	129·72	129·54	121·13
	±0·67	±0·59	±0·60	±0·74	±0·66	±0·71	±0·58	±0·57	±0·61	±0·70	±0·59
Bigonial ..	96·00	100·59	96·34	95·64	96·75	96·67	94·63	94·46	94·54	96·82	87·69
	±0·83	±0·66	±0·67	±0·72	±0·85	±0·79	±0·80	±0·61	±0·75	±0·66	±0·50
Nasion to Crinion ..	55·86	58·19	54·12	59·19	52·78	56·43	56·52	57·19	59·22	61·32	52·90
	±0·77	±0·73	±0·78	±0·74	±0·94	±0·82	±0·86	±0·73	±0·67	±1·13	±0·66
Crinion to Menton ..	166·64	169·80	163·86	167·58	164·02	169·47	168·00	166·35	166·04	170·58	157·4[illegible]
	±1·05	±0·85	±1·10	±0·93	±1·09	±0·97	±0·95	±1·00	±0·99	±1·55	±1·16
Total Facial Length ..	115·88	116·87	115·42	114·79	116·49	117·69	115·65	114·40	113·94	116·64	107·31
	±0·59	±0·73	±0·77	±0·68	±0·98	±0·80	±0·69	±0·65	±0·52	±0·97	±0·8[illegible]
Upper Facial Length ..	65·08	64·63	62·30	63·1[illegible]	63·31	63·96	64·08	62·12	63·70	64·30	59·67
	±0·63	±0·54	±0·49	±0·5[illegible]	±0·64	±0·56	±0·46	±0·71	±0·47	±0·56	±0·55
Orbito-Nasal Breadth ..	97·46	98·72	97·88	97·7[illegible]	97·65	99·63	96·92	95·88	97·80	[illegible]8·72	94·15
	±0·40	±0·44	±0·38	±0·53	±0·54	±0·49	±0·44	±0·48	±0·36	±0·6[illegible]	±0·31
Orbito-Nasal Arc ..	107·50	110·13	107·58	10[illegible]·73	107·80	109·20	106·33	105·65	109·48	108·60	101·98
	±0·56	±0·49	±0·62	±0·64	±0·64	±0·67	±0·5[illegible]	±0·64	±0·43	±0·75	±0·48

TABLE 4.

Comparative Standard Deviations for series of Bastar Males (with Standard Errors), one group of Muria Females of Bastar and one group of Nawagharia Gonds of C.P.

	(54) ♂ Bhatras	(50) ♂ D. Marias	(50) ♂ Dhakars	(52) ♂ Gadba	(51) ♂ Halba	(51) ♂ Hill Maria	(52) ♂ Muria	(52) ♂ Murias	(50) ♂ Nawagharia Gonds	(50) ♂ Parjas	(52) ♀ Maria Females
Stature	5·83 ± 0·56	6·09 ± 0·61	5·86 ± 0·59	5·87 ± 0·57	5·15 ± 0·57	4·94 ± 0·49	5·31 ± 0·52	4·88 ± 0·48	5·25 ± 0·52	6·20 ± 0·62	4·19 ± 0·41
Span	6·15 ± 0·59	7·70 ± 0·77	7·74 ± 0·77	7·12 ± 0·70	6·62 ± 0·66	6·53 ± 0·65	7·46 ± 0·73	5·95 ± 0·58	6·62 ± 0·66	8·50 ± 0·85	....
Head Length	5·54 ± 0·53	7·05 ± 0·71	5·86 ± 0·59	5·80 ± 0·57	7·43 ± 0·74	5·18 ± 0·51	5·16 ± 0·51	6·13 ± 0·60	5·22 ± 0·52	6·74 ± 0·67	5·94 ± 0·58
Head Breadth	4·79 ± 0·46	5·16 ± 0·52	4·54 ± 0·45	5·51 ± 0·54	5·43 ± 0·54	3·59 ± 0·36	3·72 ± 0·37	2·16 ± 0·21	4·33 ± 0·43	4·99 ± 0·50	4·11 ± 0·40
Auricular Height	0·55 ± 0·05	0·54 ± 0·06	0·53 ± 0·06	0·58 ± 0·06	0·71 ± 0·07	0·68 ± 0·07	0·50 ± 0·05	0·73 ± 0·07	0·54 ± 0·06	0·53 ± 0·05	0·62 ± 0·06
Nasal Length	2·95 ± 0·28	2·96 ± 0·30	3·13 ± 0·31	2·58 ± 0·25	3·96 ± 0·39	2·46 ± 0·24	3·01 ± 0·30	2·91 ± 0·29	2·93 ± 0·29	3·76 ± 0·37	3·26 ± 0·32
Nasal Breadth	2·50 ± 0·24	2·42 ± 0·24	2·37 ± 0·24	2·47 ± 0·24	3·28 ± 0·33	2·50 ± 0·25	2·34 ± 0·23	2·05 ± 0·20	2·39 ± 0·24	2·75 ± 0·28	2·29 ± 0·23
Nasal Height	1·91 ± 0·18	1·96 ± 0·20	1·58 ± 0·16	1·15 ± 0·11	2·02 ± 0·20	2·06 ± 0·20	1·58 ± 0·16	1·62 ± 0·16	1·71 ± 0·17	1·54 ± 0·16	1·53 ± 0·15
Bizygo. Breadth	4·32 ± 0·42	4·73 ± 0·47	4·26 ± 0·42	5·37 ± 0·52	4·70 ± 0·47	5·07 ± 0·50	4·15 ± 0·41	4·08 ± 0·40	4·31 ± 0·43	4·94 ± 0·49	4·29 ± 0·42
Bigonial Breadth	4·88 ± 0·47	5·90 ± 0·59	4·74 ± 0·47	5·20 ± 0·51	6·09 ± 0·60	5·66 ± 0·56	5·80 ± 0·57	4·41 ± 0·43	5·34 ± 0·53	4·65 ± 0·47	3·58 ± 0·35
Nasion to Crinion	5·40 ± 0·52	5·41 ± 0·54	5·43 ± 0·55	5·36 ± 0·52	6·73 ± 0·66	5·84 ± 0·58	6·22 ± 0·61	5·30 ± 0·52	4·76 ± 0·47	7·98 ± 0·80	4·75 ± 0·47
Crinion to Menton	6·26 ± 0·60	7·39 ± 0·74	7·81 ± 0·78	6·71 ± 0·66	7·81 ± 0·77	6·95 ± 0·69	6·84 ± 0·67	7·20 ± 0·71	7·00 ± 0·70	10·93 ± 1·10	8·39 ± [illegible]·82
Total F. Length	5·33 ± 0·52	4·15 ± 0·42	5·46 ± 0·54	4·92 ± 0·48	6·97 ± 0·69	5·73 ± 0·57	4·94 ± 0·49	4·68 ± 0·46	3·66 ± 0·37	6·84 ± 0·69	6·01 ± 0·59
Upper F. Length	3·98 ± 0·38	4·48 ± 0·45	3·44 ± 0·35	3·46 ± 0·35	4·58 ± 0·45	3·98 ± 0·39	3·33 ± 0·33	5·10 ± 0·50	3·31 ± 0·33	3·99 ± 0·40	3·97 ± 0·39
Orbito-N. Breadth	3·26 ± 0·31	2·81 ± 0·28	2·67 ± 0·27	3·85 ± 0·37	3·88 ± 0·38	3·48 ± 0·34	3·20 ± 0·31	3·43 ± 0·34	2·58 ± 0·25	4·56 ± 0·45	2·23 ± 0·22
Orbito-N. [illegible]	3·61 ± 0·35	3·96 ± 0·40	4·38 ± 0·44	4·59 ± 0·45	4·59 ± 0·45	4·79 ± 0·47	4·13 ± 0·40	4·64 ± 0·45	3·07 ± 0·30	5·27 ± 0·53	3·48 ± 0·34

Bizygo. = Bizygomatic; F. = Facial; N. = Nasal.

TABLE 5.

Significance Ratios for the Bastar Series and one group of N.G. Gonds. (*Comparison of Means and Standard Errors.*) (*Values above two are given.*)

	Bhatras and D. Marias.	Bhatras and Dhakars.	Bhatras and Gadabas.	Bhatras and Halbas.	Bhatras and Hill Marias.	Bhatras and Murias.	Bhatras and K. Murias.	Bhatras and N.G. Gonds.
Stature ..	..	2·40	2·54	2·63	..	..	3·00	2·00
Span ..	..	3·90	3·22	2·23	..	..	3·85	..
A.H. ..	1·88	3·30	..	..	..	..	..	..
H. Length ..	3·14	..	..	3·60	..	..	..	..
H. Breadth ..	..	2·10	3·15	..	2·41	4·00	6·76	..
N. Length ..	..	..	..	..	..	..	5·44	..
N. Breadth ..	2·52	6·77	2·10	4·01	..	4·58	5·37	3·81
N. Height ..	3·69	6·23	5·00	2·21	4·52	9·21	8·90	6·40
Bizygomatic	..	2·32	..	2·25	..	2·91	4·10	..
Bg. ..	4·33	4·61	5·54	3·59	3·84	5·79	6·88	6·61
N.C. ..	2·19	3·84	..	4·54	..	..	..	..
C.M. ..	2·34	4·27	..	4·18	..	..	2·64	2·89
ONB ..	2·13	..	..	..	..	2·90	4·36	..
ONA ..	3·55	3·22	2·96	2·87	..	5·04	5·53	..
TFL ..	..	..	2·10	..	..	..	2·54	3·29
UFL ..	..	3·19	2·06	..	..	..	2·82	..
Mean Sig. Ratio ..	1·61	2·88	1·79	1·88	0·67	2·15	3·88	1·56

	Bhatras and Parjas.	Dandarin Marias and Dhakars.	D. Marias and Gadabas.	D. Marias and Halbas.	D. Marias and Hill Marias.	D. Marias and N. Murias.	D. Marias and K. Murias.	D. Marias and N.G. Gonds.
Stature ..	..	..	..	..	2·34	..	..	..
Span ..	..	2·27	2·27	..	..	..	2·70	..
A.H. ..	..	..	..	..	..	2·30	..	..
H. Length ..	3·18	..	..	..	3·30	..	2·37	..
H. Breadth ..	..	..	..	2·45	..	..	4·31	..
N. Length ..	..	..	..	..	..	..	4·22	..
N. Breadth ..	..	4·25	..	..	..	..	2·13	..
N. Height ..	3·41	2·05	..	..	..	5·00	4·85	..
Bizygomatic	..	..	..	..	..	..	2·01	..
Bg. ..	3·85	..	..	..	..	..	..	..
N.C. ..	4·47	..	3·11	2·52	..	..	..	3·29
C.M. ..	..	..	..	..	..	..	..	..
ONB ..	..	..	..	..	3·44	..	2·54	..
ONA ..	..	..	..	..	..	2·17	2·78	..
TFL ..	..	..	..	..	..	..	..	2·45
UFL ..	..	3·47	2·42	..	..	..	3·11	..
Mean Sig. Ratio ..	0·93	0·75	0·48	0·31	0·56	0·59	1·93	0·35

Significance Ratios for the Bastar Series and one group of N.G. Gonds. (Comparison of Means and Standard Errors.) (Values above two are given.)

Continued fron the previous Table.

	D. Marias and Parjas.	Dhakars and Gadabas.	Dhakars and Halbas.	Dhakars and Hill Marias.	Dhakars and N. Murias.	Dhakars and K. Murias.	Dhakars and N.G. Gonds.	Dhakars and Parjas.
Stature ..	2·30	..	..	3·60	2·19	..	..	3·43
Span ..	..	..	..	3·86	2·17	..	2·41	3·73
A.H. ..	2·90	..	2·03	2·91	3·30	..	..	4·20
H. Length ..	..	..	..	2·10	..	..	..	..
H. Breadth ..	3·32	..	2·98	..	..	4·31	..	3·64
N. Length ..	..	..	..	..	..	5·62	..	..
N. Breadth ..	..	4·66	..	5·18	2·85	2·50	2·95	4·64
N. Height ..	..	2·29	3·65	..	3·32	2·83	..	3·09
Bizygomatic	..	..	..	2·38	..	..	..	..
Bg. ..	..	..	..	..	..	2·08	..	..
N.C. ..	3·98	4·68	..	2·04	2·06	2·89	5·06	5·38
C.M. ..	2·11	2·58	..	3·81	2·85	..	..	3·53
ONB ..	..	..	..	2·83	..	3·27	..	..
ONA ..	..	..	..	..	..	2·16	2·53	..
TFL ..	..	..	..	2·04	..	..	..	..
UFL ..	..	..	..	2·30	2·65	..	2·05	2·70
Mean Sig. Ratio ..	0·91	0·88	0·54	2·06	1·58	1·60	0·93	2·14

	Gadabas and Halbas.	Gadabas and Hill Marias.	Gadabas and N. Murias.	Gadabas and K. Murias.	Gadabas and N.G. Gonds.	Gadabas and Parjas.	Halbas and Hill Marias.	Halbas and N. Murias.
Stature ..	..	3·79	2·33	..	..	3·56	3·98	2·44
Span ..	..	3·20	..	..	..	3·06	2·24	..
A.H. ..	..	..	..	..	..	..	..	..
H. Length ..	2·25	..	..	..	..	..	3·65	2·06
H. Breadth ..	3·80	..	..	2·03	..	4·54	..	..
N. Length ..	2·15	2·57	..	3·88	..	..	3·17	4·49
N. Breadth ..	2·18	..	2·39	2·58	..	..	2·90	..
N. Height ..	2·06	..	8·25	7·50	..	..	2·20	6·66
Bizygomatic	..	..	..	..	..	..	2·14	..
Bg. ..	..	..	..	..	..	..	..	..
N.C. ..	2·50	2·36	..	..	..	2·96	2·94	3·76
C.M. ..	2·49	..	..	..	..	..	3·73	2·79
ONB ..	..	2·66	..	2·63	..	..	2·71	..
ONA ..	..	..	..	2·28	2·27	..	..	..
TFL ..	..	2·76	..	..	..	..	..	..
UFL ..	..	..	..	..	..	..	..	..
Mean Sig. Ratio ..	1·08	1·07	0·71	1·30	0·14	0·77	1·75	1·37

Significance Ratios for the Bastar Series and one group of N.G. Gonds. (Comparison of Means and Standard Errors.) (Values above two are given.)
Continued from the previous Table.

	Halbas and K. Murias.	Halbas and N.G. Gonds.	Halbas and Parjas.	Hill Marias and N. Murias.	Hill Marias and K. Murias.	Hill Marias and N.G. Gonds.	Hill Marias and Parjas.	N. Murias and K. Murias.
Stature ..	..	..	3·71	..	4·41	3·28	..	2·82
Span ..	..	..	2·22	..	3·80	..	..	..
A.H. ..	..	..	..	..	..	..	..	..
H. Length ..	2·86	2·04	..	2·15	..	2·08	3·35	..
H. Breadth ..	2·12	2·48	..	..	4·93	..	4·04	2·71
N. Length ..	7·06	..	..	..	5·94	..	..	4·54
N. Breadth ..	..	..	2·13	2·96	3·15	2·22	..	..
N. Height ..	6·17	3·06	..	4·76	3·35	..	..	..
Bizygomatic	..	..	..	2·83	3·88	..	..	..
Bg. ..	2·12	..	..	..	2·23	..	..	..
N.C. ..	5·60	5·80	..	..	..	2·65	3·49	..
C.M. ..	..	..	3·47	..	2·24	2·49	..	..
ONB ..	2·45	..	..	4·10	5·43	3·00	..	..
ONA ..	2·38	2·18	..	3·26	3·83	..	..	..
TFL ..	..	2·29	..	..	3·19	3·93	..	..
UFL ..	..	..	..	..	2·02	..	..	2·30
Mean Sig. Ratio ..	1·91	0·69	0·72	1·25	3·02	1·22	0·67	0·77

	N. Murias and N.G. Gonds.	N. Murias and Parjas.	K. Murias and N.G. Gonds.	K. Murias and Parjas.	N.G. Gonds and Parjas.
Stature ..	..	..	..	4·08	3·11
Span ..	..	..	2·14	3·29	..
A.H. ..	2·07	..	..	2·45	2·64
H. Length ..	..	..	..	2·36	..
H. Breadth ..	2·06	5·39	5·46	8·28	3·33
N. Length ..	..	..	5·06	3·91	..
N. Breadth ..	..	2·36	..	2·54	..
N. Height ..	4·10	..	3·37	5·93	2·39
Bizygomatic	..	..	3·08	2·67	..
Bg. ..	..	2·12	..	2·96	2·30
N.C. ..	2·47	3·38	2·05	3·08	..
C.M. ..	..	..	..	2·29	2·46
ONB ..	..	2·33	3·20	3·55	..
ONA ..	4·43	2·41	4·84	3·00	..
TFL ..	..	..	..	..	2·45
UFL ..	..	..	..	2·42	..
Mean Sig. Ratio ..	0·94	1·12	1·82	3·29	1·16

FIG. 1. Nawagharia Gond.

FIG. 2. Profile of Fig. 1.

FIG. 3. Muria, Kondagaon, Bastar, C.P.

FIG. 4. Profile of Fig. 3.

FIG. 1. Dandami Maria.

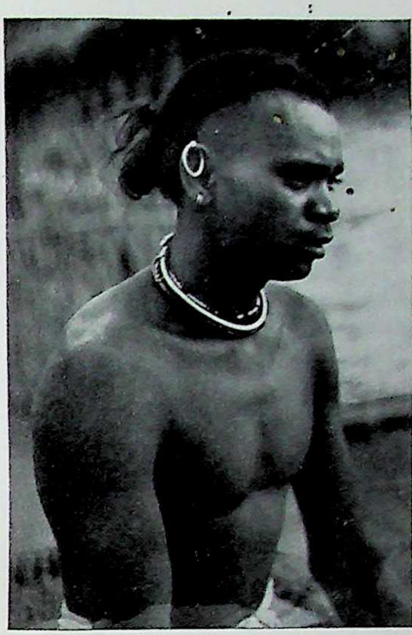


FIG. 2. Profile of Fig. 1.

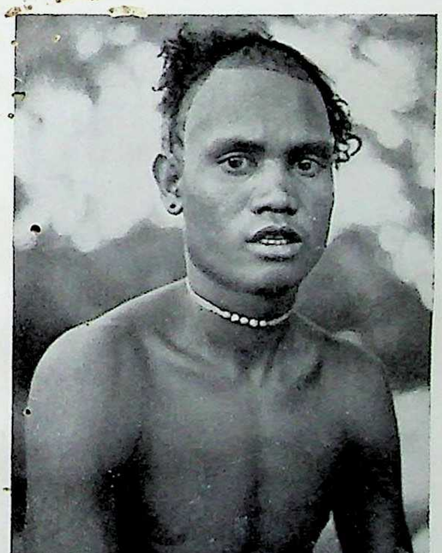


FIG. 3. Hill Maria.

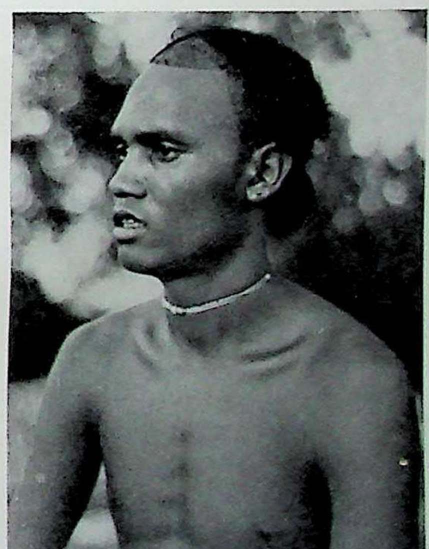


FIG. 4. Profile of Fig. 3.

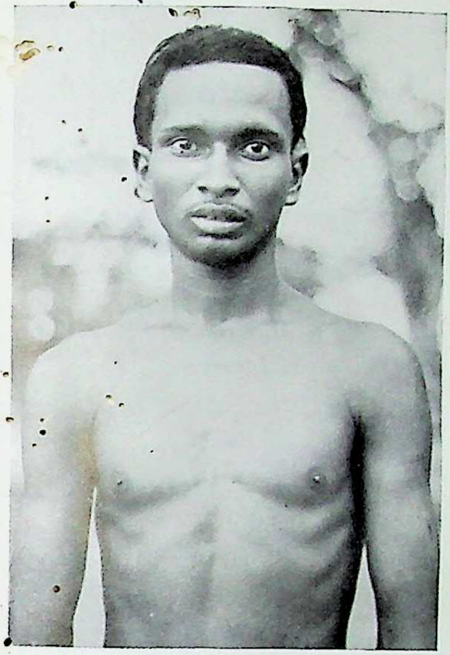


FIG. 1. Dhakar.

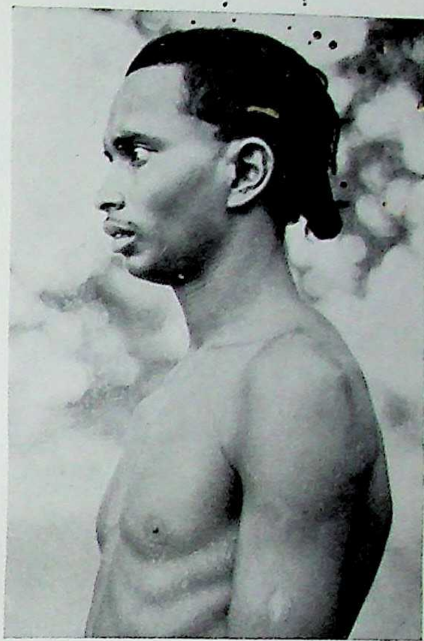


FIG. 2. Profile of Fig. 1.

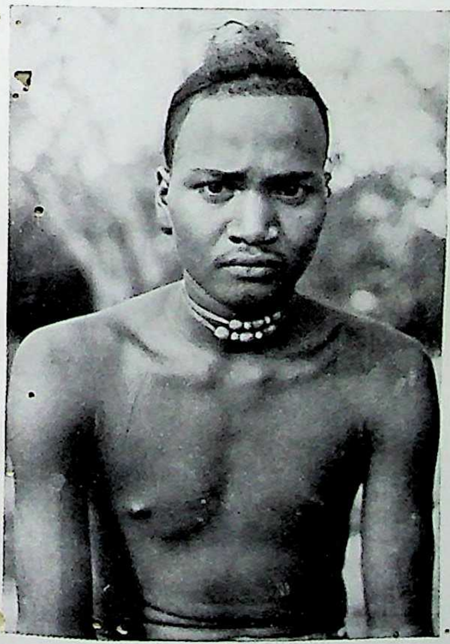


FIG. 3. Gadaba.

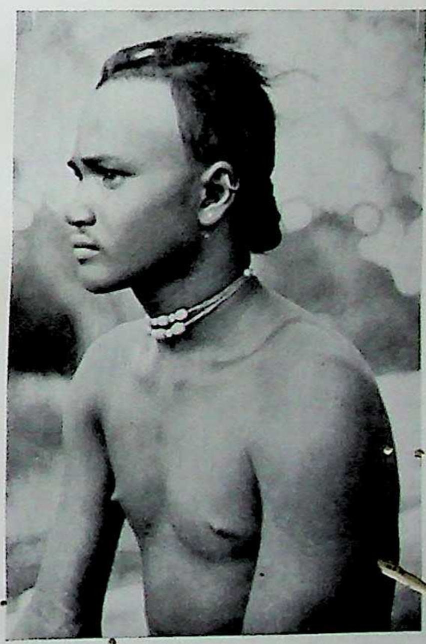


FIG. 4. Profile of Fig. 3.

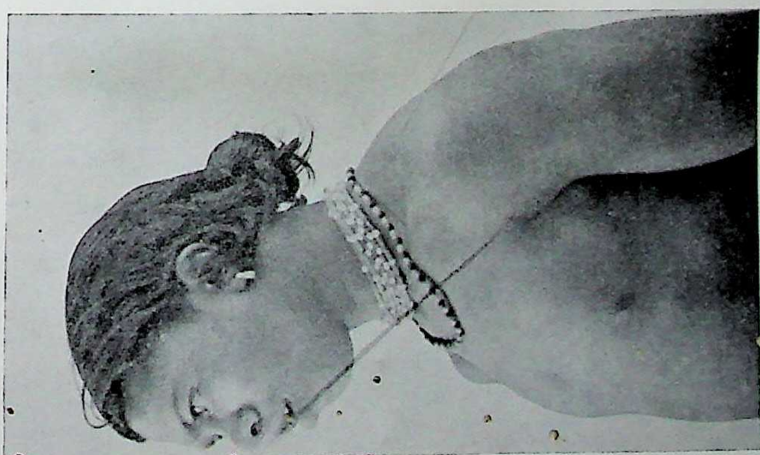


FIG. 1. Muria Youth, Narayanpur.

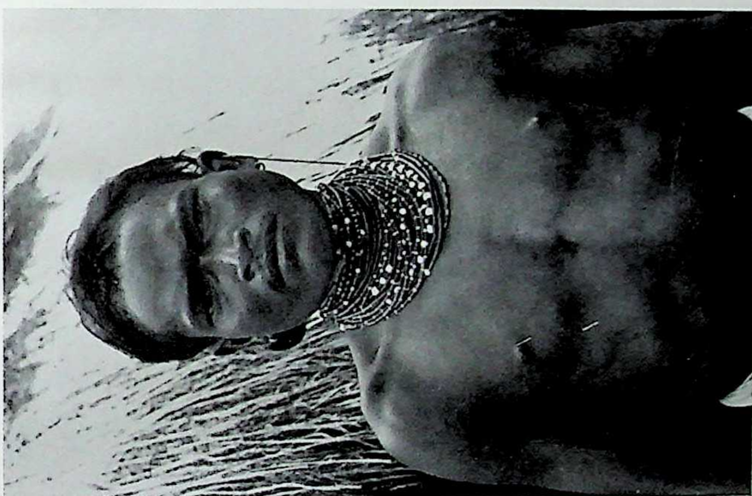


FIG. 2. Parja, Bastar.

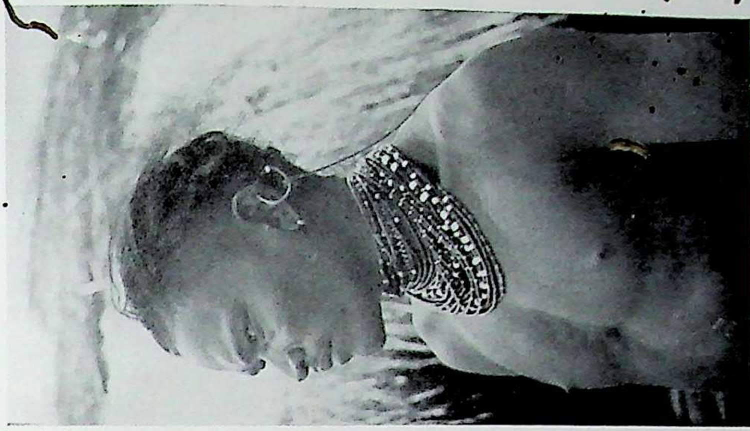


FIG. 3. Profile of Fig. 2.

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ARTICLE No. 6.

Notes on *Cayratia* and *Tetrastigma*.

By FRANKLIN P. METCALF.

(*Communicated by Dr. K. P. Biswas.*)

Recently in connection with the preparation of my 'Flora of Fukien', with notes on South-eastern China, I was unable to settle definitely the status of the two specimens collected in Hainan in 1921 and 1922 by Professor F. A. McClure. These had variously been interpreted as *Columella Wrayi* (King), Merrill, or as *Cayratia papillata* (Hance), Merrill and Chun, which last was considered by Merrill and Chun as possibly being the same as *Cayratia Wrayi* (King), Gagnepain.

Through the kindness of Dr. K. P. Biswas, Superintendent of the Royal Botanical Gardens, Sibpur, Calcutta, India, I have been fortunate in obtaining two photographs of two different sheets of *Scortechini 426* from Perak, as well as a drawing, and 2 or 3 fruits with seeds, this representing one of the syntypes listed by King when he described *Vitis Wrayi*. At the Arnold Arboretum I have a photograph of the type of Hance's species *Vitis papillata* Hance (= *Cayratia papillata*, Merrill and Chun), namely, *Bullock, herb. Hance 20297* from Hoihau, Hainan, and a specimen collected from Hung Mo Shan, Hainan, collected by *Tsang, Tang* and *Fung, LU 17595*, which agrees very well with the photograph of the type of *Vitis papillata* Hance.

A comparison of the available photographs, drawings, and merotype show that the species of King, originally described as *Vitis Wrayi* and that of Hance, originally described as *Vitis papillata*, are the same and that they both represent a species of *Cayratia* and not *Tetrastigma*.

Gagnepain, Merrill and Chun, and more recently Biswas (in litt.) consider this to be a *Cayratia*, not a *Tetrastigma*, though Craib has placed his Siam material under *Tetrastigma*.

The early material from Hainan collected by McClure is something entirely different; it is a species of *Tetrastigma*, apparently undescribed, and is here proposed as a new species.

1. *Cayratia papillata* (Hance) Merrill and Chun, in *Sunyatsenia*, **5**, 118 (1940).

Vitis papillata Hance, *Journ. Bot.*, **16**, 226 (1878).
Vitis Wrayi King, *Journ. Asiat. Soc. Bengal*, 64(2), **8**, 394 (Mat. Fl. Malay Pen. 680) (1896); Ridley Fl. Malay Pen., 475 (1922).
Cayratia Wrayi Gagnepain, Not. Syst., 1, 340 (1911), and in Lecomte Fl. Gén. Indo-Chine, 1, 978 (1912).
Tetrastigma Wrayi Craib, Fl. Siam. Enum., 1, 314 (1926).

This species as now represented extends from Perak to Siam [*Mrs. Collins 649* and *699*, *ex* Craib], to Indo-China [*Pierre 4432*, *ex* Gagnepain], and to Hainan [*Bullock*, *herb. Hance 20297*, type, and *LU 17595* (*Tsang*, *Tang* and *Fung*), *ex* Merrill and Chun]. No specimens from Indo-China or Siam are available to the writer, but Gagnepain's treatment of this group is very critical, so his crediting of this species to Indo-China is probably correct. I am not so sure of Craib's record for Siam, as he recognizes both *Cayratia* and *Tetrastigma* and still has made the new combination *Tetrastigma Wrayi* (King), Craib, combining the Perak and Siam (Prachinburi and Nawng Kaw) material. His Flora, however, was done at Kew, where he surely had type material of King's species for comparison.

2. *Tetrastigma Biswasiana* Metcalf spec. nov.

Columella Wrayi (King) Merrill, *Ling. Sci. Journ.*, **5**, 122 (1927), *non Cayratia Wrayi* (King) Gagnepain, *excl. syns. cit. et quoad spec. cit. e* Hainan.

Tetrastigma Henryi Merrill and Chun, *Sunyatsenia*, **2**, 39 (1934), *non* Gagnepain.

Frutex scandens, glaber, ramulis ultimis longitudinaliter sulcatis 1·5 mm. diametro, ramis teretibus, internodis 6 ad 8 cm. longis; foliis trifoliatis, petiolo 3·5–6 cm. rare ad 8 cm. longo; foliolis lateralibus oblique oblongo-lanceolatis, apice abrupte acutis vel acuminatis, ad basim rotundatis, petiolulo circiter 8 mm. longo, foliis terminalibus ellipticis, apice abrupte acutis vel acuminatis, ad basim cuneatis, utrinque glabris, leviter reticulatis, viridibus vel olivaceis, venis primariis 7–12 conspicuis, margine subintegerrimis vel distanter et minute denticulatis, glanduloso-apiculatis; petiolulo circiter 30 mm. longo; inflorescentiis axillaribus, pedunculatis, circiter 4–6 cm. longis et 6 cm. rare 10 cm. latis, cymoso-paniculatis, plurifloris, parce et minute puberulentibus; calycibus minutis lobis 4, late triangularibus; petalis glabris, ovatis, 1·2 mm. longis latisque, apice cucullatis dorso corniculatis, corniculo terete, uncinato, obtuso; staminibus minutis; disco undulato vel crenulato; stigmatibus 4-lobis; fructibus ellipsoideis nigris, 5–10 mm. longis et 3–5 mm. latis, pedicello 5 mm. longo parce et minute pubescente.

Hainan: Hong Ma Ts'un, *CCC. 8308* (*McClure*), type, Dec. 3, 1921, (CCC. and AA.). Additional numbers not available now at the Arnold Arboretum and included on the same printed labels, namely, *CCC. 8276*, *9194*, *9413*, *9544*, and also cited by Merrill (l.c.) in his enumeration of Hainan plants, probably represent the same species, but should be seen and verified, as typical *Cayratia papillata* (Hance), Merrill and Chun, has also been collected from one of the same sublocalities, Hung Mo Shan (Five Finger Mountain) in Hainan. The following numbers from Hainan, all originally distributed as *T. Henryi*, Gagnepain, also belong here, namely: Chang-kiang, *S. K. Lau* 1399, Poting,

F. C. How 71657, type of flower, *71766* and *Ko 52206*, and without detailed local locality, *C. Wang 36226* and *S. P. Liang 55220*. The leaflets in *Ko 52206* and *How 71657* are somewhat undulate.

This species in general appearance suggests *Cayratia papillata* (Hance) Merrill and Chun [*Cayratia Wrayi* (King) Gagnepain] but in addition to the fact that this is a *Tetrastigma* and not a *Cayratia*, it can be separated by the broader, more oblong-elliptic leaves, with abruptly acute to acuminate, not gradually acuminate apices, more numerous veins, less prominently denticulate undulate margins, and elliptical, not subglobose, fruits. In *Tetrastigma* its nearest affinity is *Tetrastigma Henryi* Gagnepain, which has more prominently undulate-serrate margins to the 3-4 foliolate to 5 foliate, pedate leaves, and by its pubescent, not glabrous, petals and puberulent, not subglabrous, pedicels of the fruit.

This species is named in honour of Dr. K. P. Biswas, Superintendent of the Royal Botanical Gardens, Calcutta, whose cooperation and courtesy have made the preparation of this paper possible.

ARNOLD ARBORETUM,
Harvard University,
September 4, 1941.

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